
Volume 2: Quality Assurance Project Plan Ruetgers-Nease Salem, Ohio Site

Revision 4: February 28, 1990
Revision 3: December 13, 1989
Revision 2: August 3, 1989
Revision 1: October 22, 1988

Submitted to

United States Environmental Protection Agency, Region 5
Hazardous Waste Enforcement Branch
230 S. Dearborn St.
Chicago, Illinois 60604

Ohio Environmental Protection Agency
Corrective Actions Section
Division of Solid and Hazardous Waste Management
1800 Watermark Dr.
Columbus, Ohio 43266

Northeast District Office
Division of Solid and Hazardous Waste Management
2110 Aurora Rd.
Twinsburg, Ohio 44087

Submitted by

Ruetgers-Nease
Chemical Company, Inc.
201 Struble Rd.
State College, Pennsylvania 16801

EPA Region 5 Records Ctr.



231120

Section	Title	Page
1.0	TITLE PAGE.....	QAPP-i
2.0	TABLE OF CONTENTS.....	QAPP-ii
2.1	List of Figures.....	QAPP-viii
2.2	List of Tables.....	QAPP-xi
3.0	PROJECT DESCRIPTION.....	QAPP-1
3.1	Site Background and History.....	QAPP-1
3.1.1	Location.....	QAPP-1
3.1.2	History.....	QAPP-5
3.1.3	Existing Conditions.....	QAPP-9
3.2	Problem Statement.....	QAPP-10
3.2.1	Sources.....	QAPP-10
3.2.2	Affected Media.....	QAPP-10
3.3	Project Objectives.....	QAPP-10
3.4	Time Schedule.....	QAPP-14
3.4.1	ERM's Time Schedule.....	QAPP-14
3.4.2	Enseco's Time Schedule.....	QAPP-16
3.5	Intended Data Use.....	QAPP-16
3.6	Sample Network and Rationale.....	QAPP-17
3.7	Monitoring Parameters and Frequency of Collection.....	QAPP-25
4.0	PROJECT ORGANIZATION AND RESPONSIBILITY.....	QAPP-33
4.1	Organization.....	QAPP-33
4.2	Overall Management and QA/QC Responsibilities.....	QAPP-37
4.2.1	Project Coordinator.....	QAPP-37
4.2.2	Principal-in-Charge.....	QAPP-37
4.2.3	Project QA/QC Manager.....	QAPP-39
4.2.4	RI Project Manager.....	QAPP-39
4.2.5	Field Operations Manager...	QAPP-40
4.2.6	Analytical Laboratory QA Manager.....	QAPP-40
4.2.7	Laboratory Sample Custodians.....	QAPP-41

Section	Title	Page
	4.2.8 U.S. EPA Remedial Project Manager and OEPA Project Coordinator.....	QAPP-42
	4.2.9 U.S. EPA/OEPA QA Manager...	QAPP-42
	4.2.10 U.S. EPA Region V Central Regional Laboratory.....	QAPP-43
5.0	QA OBJECTIVES FOR MEASUREMENT DATA.....	QAPP-44
5.1	PSARCC Objectives.....	QAPP-44
	5.1.1 Precision.....	QAPP-46
	5.1.2 Sensitivity.....	QAPP-50
	5.1.3 Accuracy.....	QAPP-50
	5.1.4 Representativeness.....	QAPP-50
	5.1.5 Comparability.....	QAPP-51
	5.1.6 Completeness.....	QAPP-52
5.2	QA Objectives for Critical Samples.....	QAPP-52
5.3	Procedures for Monitoring PSARCC Parameters.....	QAPP-54
5.4	Field Measurements.....	QAPP-54
6.0	SAMPLING PROCEDURES.....	QAPP-63
6.1	Sampling Rationale.....	QAPP-63
6.2	Sampling Protocol Summary.....	QAPP-63
	6.2.1 Surface Soils.....	QAPP-63
	6.2.2 Subsurface Soils.....	QAPP-64
	6.2.3 Surface Water and Sediment Sampling.....	QAPP-66
	6.2.4 Groundwater.....	QAPP-67
	6.2.5 Fish Sampling.....	QAPP-69
	6.2.6 Air Sampling.....	QAPP-69
6.3	Sample Packing, Handling and Shipment.....	QAPP-73
6.4	Sample Containers, Preservatives and Holding Times.....	QAPP-75
6.5	Preparation of Sampling Equipment and Containers.....	QAPP-75
	6.5.1 Decontamination of Sampling Equipment.....	QAPP-75
	6.5.2 Preparation of Sample Containers.....	QAPP-82

Section	Title	Page
6.6	Documentation of Sampling Activities.....	QAPP-85
6.6.1	Log In/Log Out Record.....	QAPP-86
6.6.2	Field Notebooks.....	QAPP-86
6.6.3	Sample Log Book.....	QAPP-87
6.6.4	Photo-Documentation.....	QAPP-89
6.6.5	Correspondence/ Communications.....	QAPP-89
6.7	Summary of Sampling and Analysis...	QAPP-89
6.7.1	Quality Control Samples.....	QAPP-89
7.0	SAMPLE CUSTODY.....	QAPP-92
7.1	Field Activities Sample Custody....	QAPP-92
7.2	Enseco Sample Custody.....	QAPP-94
7.3	Final Evidence Files.....	QAPP-114
7.3.1	ERM's Final Evidence File...	QAPP-114
7.3.2	Enseco Final Evidence File..	QAPP-114
8.0	CALIBRATION PROCEDURES AND FREQUENCY.....	QAPP-115
8.1	Field Instruments.....	QAPP-115
8.1.1	Century OVA Meter 128.....	QAPP-115
8.1.2	HNU Model P1-101 Photo- ionization Analyzer.....	QAPP-118
8.1.3	High Volume Particulate Sampling.....	QAPP-118
8.1.4	PUF Sampler.....	QAPP-121
8.1.5	Pump Flow Rate Calibration for the Tenax, XAD-2 and CMS Traps.....	QAPP-123
8.2	Enseco Analytical Instrumentation..	QAPP-123
8.2.1	GC/MS -- Volatiles (VOA)....	QAPP-124
8.2.2	GC/MS -- Semivolatiles and Diphenyl Sulfone and Dichloronitrobenzene.....	QAPP-124
8.2.3	GC/MS Mirex, Kepone and Photomirex.....	QAPP-125
8.2.4	GC -- Pesticides/PCBs.....	QAPP-125
8.2.5	Metals.....	QAPP-126
8.2.6	Standards.....	QAPP-127
8.2.7	Instrumentation.....	QAPP-130

Section	Title	Page
9.0	ANALYTICAL PROCEDURES.....	QAPP-134
9.1	Sample Preparation.....	QAPP-134
9.1.1	TCL Analyses: Volatiles, Semivolatiles, Pesticides, PCBs, Metals, Dioxins and Furans.....	QAPP-134
9.2	Instrument Start-Up Performance Check.....	QAPP-143
9.3	Establishment of Detection Limits for Parameters.....	QAPP-143
9.4	Initial and Continuing Calibrations.....	QAPP-144
9.5	Analytical Procedures for Each Sample Matrix and Parameter.....	QAPP-144
9.5.1	Volatile Organics in Water and Soil.....	QAPP-144
9.5.2	Semivolatile Organics in Water and Soil.....	QAPP-145
9.5.3	Pesticides/PCBs in Water and Soil.....	QAPP-145
9.5.4	Polychlorinated Dibenzo- Dioxins and Polychlorinated Dibenzofurans in Water and Soils.....	QAPP-146
9.5.5	Inorganics in Water and Soil.....	QAPP-146
9.5.6	Cyanides in Water and Soils.	QAPP-146
9.6	Chain-of-Custody.....	QAPP-147
9.7	Analytical Procedures for Non-CLP Parameters.....	QAPP-147
9.7.1	Mirex, Photomirex and Kepone in Water and Soil...	QAPP-147
9.7.2	Sample Preparation for Mirex, Photomirex and Kepone in Water.....	QAPP-148
9.7.3	Sample Preparation for Mirex, Photomirex and Kepone in Soil.....	QAPP-149
9.7.4	Analysis for Mirex, Photomirex and Kepone.....	QAPP-150

Section	Title	Page
	9.7.5 Analysis of Diphenyl Sulfone (DPS) and Dichloro-nitrobenzene (DCNB) in Water and Soil.....	QAPP-154
	9.7.6 Fish Tissue Analysis.....	QAPP-155
	9.7.7 Low-Level Detection Limits for Selected Water Samples.	QAPP-157
	9.7.8 Air Analysis.....	QAPP-158
	9.7.9 Physical Parameters.....	QAPP-161
10.0	DATA REDUCTION, VALIDATION AND REPORTING.....	QAPP-162
10.1	ERM's Data Reduction, Validation and Reporting.....	QAPP-162
10.2	Laboratory Reduction, Validation and Reporting.....	QAPP-163
	10.2.1 Data Reduction.....	QAPP-163
	10.2.2 Data Validation.....	QAPP-163
	10.2.3 Data Reporting.....	QAPP-164
11.0	INTERNAL QUALITY CONTROL.....	QAPP-166
11.1	Field Quality Control Checks.....	QAPP-166
11.2	Laboratory Quality Control Checks..	QAPP-169
	11.2.1 Trace Organic Analysis: Volatiles, Semivolatiles, Pesticides and PCBs, Dioxins, Mirex, Photomirex, and Kepone.....	QAPP-169
	11.2.2 Trace Metals Analysis.....	QAPP-170
	11.2.3 Control Limits.....	QAPP-171
12.0	PERFORMANCE AND SYSTEM AUDITS.....	QAPP-172
12.1	External Audit of Laboratory by U.S. EPA Region 5.....	QAPP-172
12.2	Laboratory Internal Audits.....	QAPP-172
12.3	On-Site Field Audit Procedures.....	QAPP-178
13.0	PREVENTATIVE MAINTENANCE.....	QAPP-184
13.1	Field Equipment Maintenance.....	QAPP-184
	13.1.1 Century OVA 128 Meter.....	QAPP-185
	13.1.2 PUF Sampling Equipment.....	QAPP-187

Section	Title	Page
	13.1.3 Tenax, XAD-2, and CMS Sampling Equipment.....	QAPP-187
	13.1.4 HNU Model P1 101 Photo- ionization Unit.....	QAPP-188
	13.1.5 High Volume Particulate Sampling Equipment.....	QAPP-188
13.2	Laboratory Preventative Maintenance.....	QAPP-190
14.0	SPECIFIC ROUTINE PROCEDURES USED TO ASSESS PRECISION, ACCURACY AND COMPLETENESS.....	QAPP-201
14.1	Overall Project Assessment.....	QAPP-201
14.2	Field Data Quality Assessment.....	QAPP-201
14.3	Enseco's Procedures.....	QAPP-202
	14.3.1 Precision.....	QAPP-202
	14.3.2 Accuracy.....	QAPP-203
	14.3.3 Analytical Completeness.....	QAPP-204
	14.3.4 Objectives.....	QAPP-204
	14.3.5 Reporting.....	QAPP-204
14.4	ERM's Laboratory Data Assessment...	QAPP-205
	14.4.1 ERM Data Validation.....	QAPP-205
14.5	Management Data Quality Assessment.	QAPP-207
15.0	CORRECTIVE ACTION.....	QAPP-209
15.1	ERM's Corrective Action.....	QAPP-209
15.2	Enseco's Corrective Action.....	QAPP-211
16.0	QUALITY ASSURANCE REPORTS TO MANAGEMENT..	QAPP-215
16.1	ERM's Quality Assurance Reports....	QAPP-215
16.2	Enseco's Quality Assurance Reports.	QAPP-216

List of Figures

Figure	Title	Page
3-1	Site Location Map.....	QAPP-2
3-2	Stratigraphic and Hydrogeological Cross-Section.....	QAPP-4
3-3	Schedule for Implementation of RI Activities.....	QAPP-15
3-4	Geophysical Survey Locations.....	QAPP-27
3-5	Monitoring Well Location Areas.....	QAPP-28
3-6	Surface Water, Sediment and Off-Site Soil Samples.....	QAPP-29
3-7	Soil Sampling Locations On-Site and Adjacent Areas.....	QAPP-30
4-1	Quality Assurance Project Organization...	QAPP-34
4-2	ERCO Laboratory Structure.....	QAPP-35
4-3	CAL Analytical Laboratory Structure.....	QAPP-36
4-4	Enseco-CRL Laboratory Structure.....	QAPP-38
6-1	Typical Logbook Entries.....	QAPP-88
7-1	ERM Chain-of-Custody Record.....	QAPP-93
7-2	ERM Custody Seal.....	QAPP-95
7-3	ERM Cooler Transfer Acknowledgement.....	QAPP-96
7-4	ERCO Sample Label.....	QAPP-97
7-5	Enseco Chain-of-Custody Record.....	QAPP-98
7-6	ERCO Shipping Log-Incoming.....	QAPP-99
7-7	Sample Receiving Form.....	QAPP-100
7-8	B/N/A Sample Tracking Logsheet.....	QAPP-103
7-9	Pesticide Sample Tracking Logsheet.....	QAPP-104

List of Figures (Cont'd)

Figure	Title	Page
7-10	Pesticide Transfer & Analysis Log.....	QAPP-105
7-11	Semi-Volatile GC/MS Sample Transfer Log..	QAPP-106
7-12	Semi-Volatile GC/MS Instrument Log.....	QAPP-107
7-13	VOA Sample Receipt Log.....	QAPP-108
7-14	VOA Instrument Log.....	QAPP-109
7-15	Trace Metals Aqueous Sample Receipt Form.	QAPP-110
7-16	Trace Metals Solid Sample Receipt Form...	QAPP-111
7-17	Inorganic Log Sheet.....	QAPP-112
7-18	Inorganic Sample Receipt Form.....	QAPP-113
8-1	Standards Log Sheet.....	QAPP-128
8-2	Standards Log Sheet.....	QAPP-129
12-1	Enseco-ERCO Audit Outline.....	QAPP-177
12-2	ERM Quality Assurance Audit.....	QAPP-179
13-1	Preventive Maintenance Schedule from ERCO's Trace Metals Laboratory Manual (AA).....	QAPP-191
13-2	Preventive Maintenance Schedule from ERCO's Trace Metals Laboratory Manual (ICP).....	QAPP-193
13-3	Preventive Maintenance Schedule from ERCO's Trace Metals Laboratory Manual (Graphite Furnace).....	QAPP-194
13-4	Preventive Maintenance Schedule for Gas Chromatographs from ERCO's Organic Laboratory Manual.....	QAPP-195

List of Figures (Cont'd)

Figure	Title	Page
13-5	Preventive Maintenance Section from ERCO's VOA Laboratory Manual.....	QAPP-199
13-6	Maintenance for GC/MS Systems.....	QAPP-200
15-1	ERM's Corrective Action Form.....	QAPP-210
15-2	ERCO Quality Assurance Corrective Action Request Form.....	QAPP-213

List of Tables

Table	Title	Page
3-1	Compounds That Have Been Qualitatively at the Ruetgers-Nease Salem Site Prior to RI/FS.....	QAPP-8
3-2	Potential Contaminant Sources, Ruetgers- Nease Salem Site RI/FS.....	QAPP-11
3-3	Affected or Potentially Affected Media...	QAPP-12
3-4	Sampling Rationale, R-N Salem Site RI/FS.....	QAPP-18
3-5	Critical RI Sampling Summary.....	QAPP-24
3-6	Estimated RI Sampling Summary.....	QAPP-26
3-7	Sampling Program for Survey of Feeder Creek, Slanker Pond, and Middle Fork of Little Beaver Creek.....	QAPP-31
5-1	Data Quality Objectives SAS.....	QAPP-47
5-2	Accuracy and Precision Data Quality Objectives for RAS and SAS Organics.....	QAPP-48
5-3	Accuracy and Precision Data Quality Objectives for RAS Inorganics.....	QAPP-49
5-4	Critical Sample Summary, Ruetgers-Nease Salem Site RI/FS.....	QAPP-53
5-5	DQO Summary Form.....	QAPP-56
5-6	Levels of Data Quality Objectives.....	QAPP-62
6-1	Sample Containers, Preservation, and Holding Times.....	QAPP-76
6-2	Sample Analysis: A Sample Summary.....	QAPP-91
8-1	Equipment Maintenance and Calibration....	QAPP-116
9-1	Target Compound List and Detection Limits for Semi-Volatile Organics.....	QAPP-136
9-2	Target Compound List and Detection Limits for Volatile Organics.....	QAPP-138

List of Tables (Cont'd)

Table	Title	Page
9-3	Target Compound List and Detection Limits for Pesticides/PCBs.....	QAPP-139
9-4	Target Compound List and Detection Limits for Inorganics.....	QAPP-140
9-5	Target Compound List and Detection Limits for Polychlorinated, Dibenzo-furans and Dibenzo-p-dioxins.....	QAPP-141
9-6	Target Compound List and Detection Limits for Mirex, Photomirex and Kepone.....	QAPP-142
9-7	Major ions in the Monitored Clusters for Mirex, Photomirex, Kepone and ¹³ C-Mirex	QAPP-152
12-1	ERCO Systems Audits, January 1987 to December 1987.....	QAPP-173
12-2	ERCO Performance Evaluations, January 1987 to December 1987.....	QAPP-174
12-3	EPA Quarterly Blind Performance Evaluation Studies.....	QAPP-176
14-1	Items Reviewed During the ERM Data Validation.....	QAPP-206

LIST OF ATTACHMENTS

- Attachment #1 Enseco's SOP for the Analysis of TCL, VOA, BNA and Pesticide/PCBs in Fish Tissue
- Attachment #2 Enseco's SOP for the Analysis of TCL, VOA, BNA and Pesticide/PCBs with Low Detection Limits in Drinking Water

3.0 PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) sets forth procedures to assure the quality, quantity, and validity of data collected during the RI/FS at the Ruetgers-Nease Chemical Company (Ruetgers-Nease), Salem, Ohio Site (the Site). This section of the QAPP describes the purpose of the plan and provides background information on site conditions.

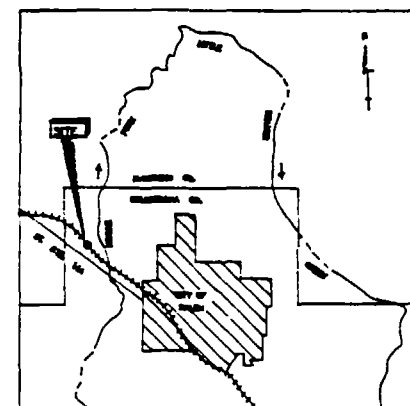
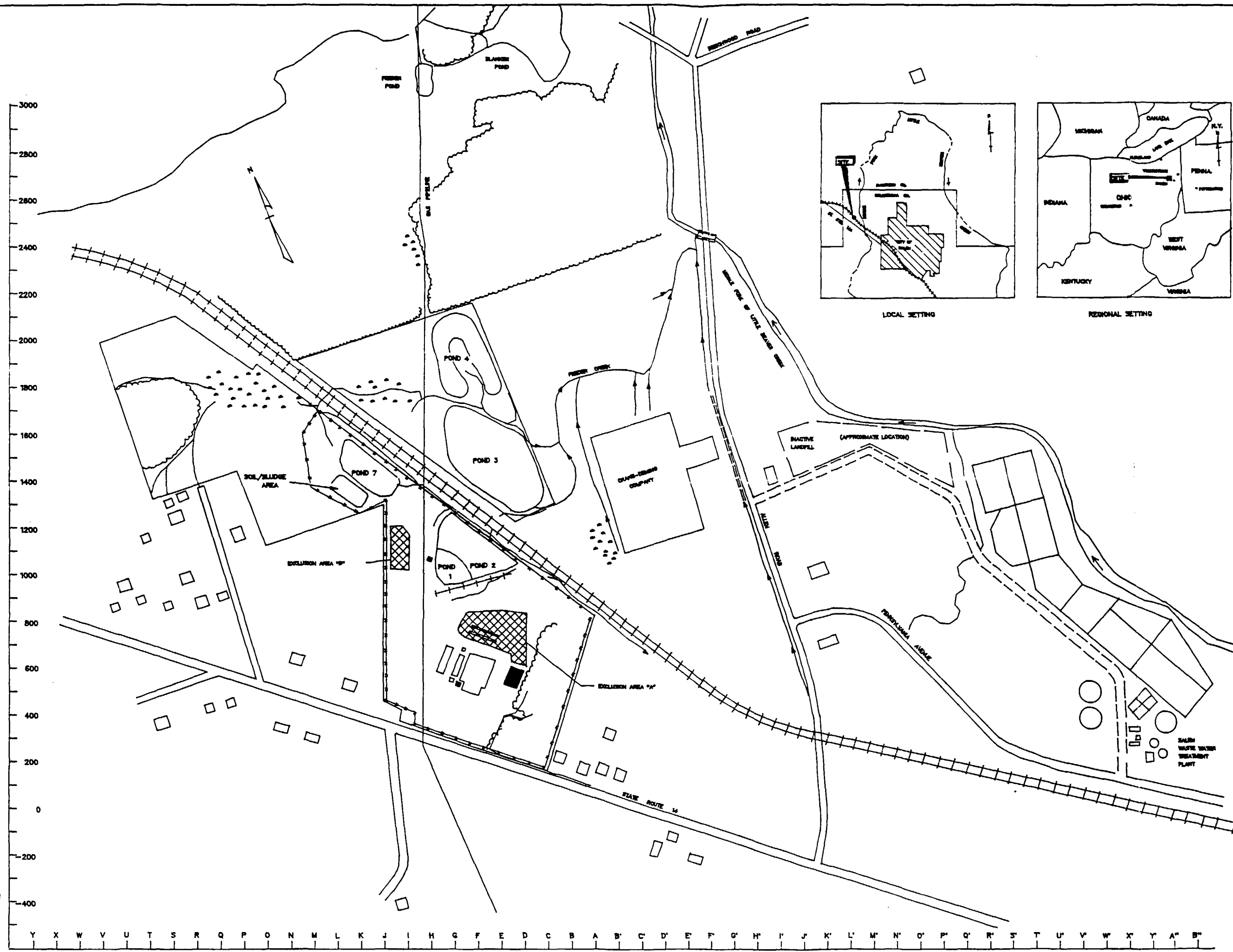
This QAPP presents the organization, objectives, functional activities, and specific sampling and analysis quality assurance (QA) and quality control (QC) procedures under which the remedial investigation at the Site will be performed. The QAPP is designed to achieve all the specific technical and data quality objectives and goals needed to identify characterize, and fully delineate the fact, nature, extent and magnitude of contaminants related to the Site in on-site and off-site locations.

3.1 Site Background and History

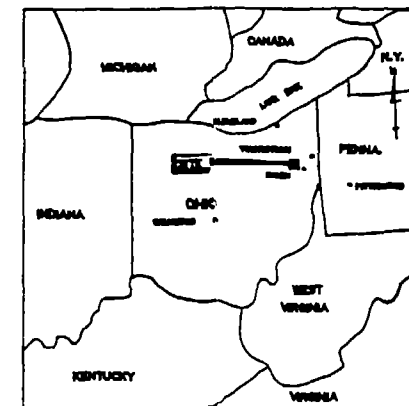
The purpose of providing background information is to educate RI/FS personnel regarding present site conditions and planned actions so that the QA/QC program outlined in this document can be understood.

3.1.1 Location

The Site is located approximately one mile northwest of the City of Salem (see Figure 3-1). Conrail railroad tracks separate the Site into two unequal sections that total approximately 44 acres. The Site is bounded by small light-industrial operations along Allen Road to the east, residences to the immediate southwest, State Route 14A to the south, and wooded areas and pasture lands to the north. Site



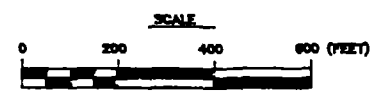
LOCAL SETTING



REGIONAL SETTING

- LEGEND**
- REMOVED ON-SITE BUILDINGS
 - EXISTING ON-SITE BUILDINGS
 - RAILROAD TRACKS
 - PROPERTY FENCE
 - SITE BOUNDARY

FIGURE QAPP 3 - 1
SITE LOCATION MAP
RUETGERS-NEASE SALIN SITE 10/73



REVISED 10.88

ERM-Midwest, inc.

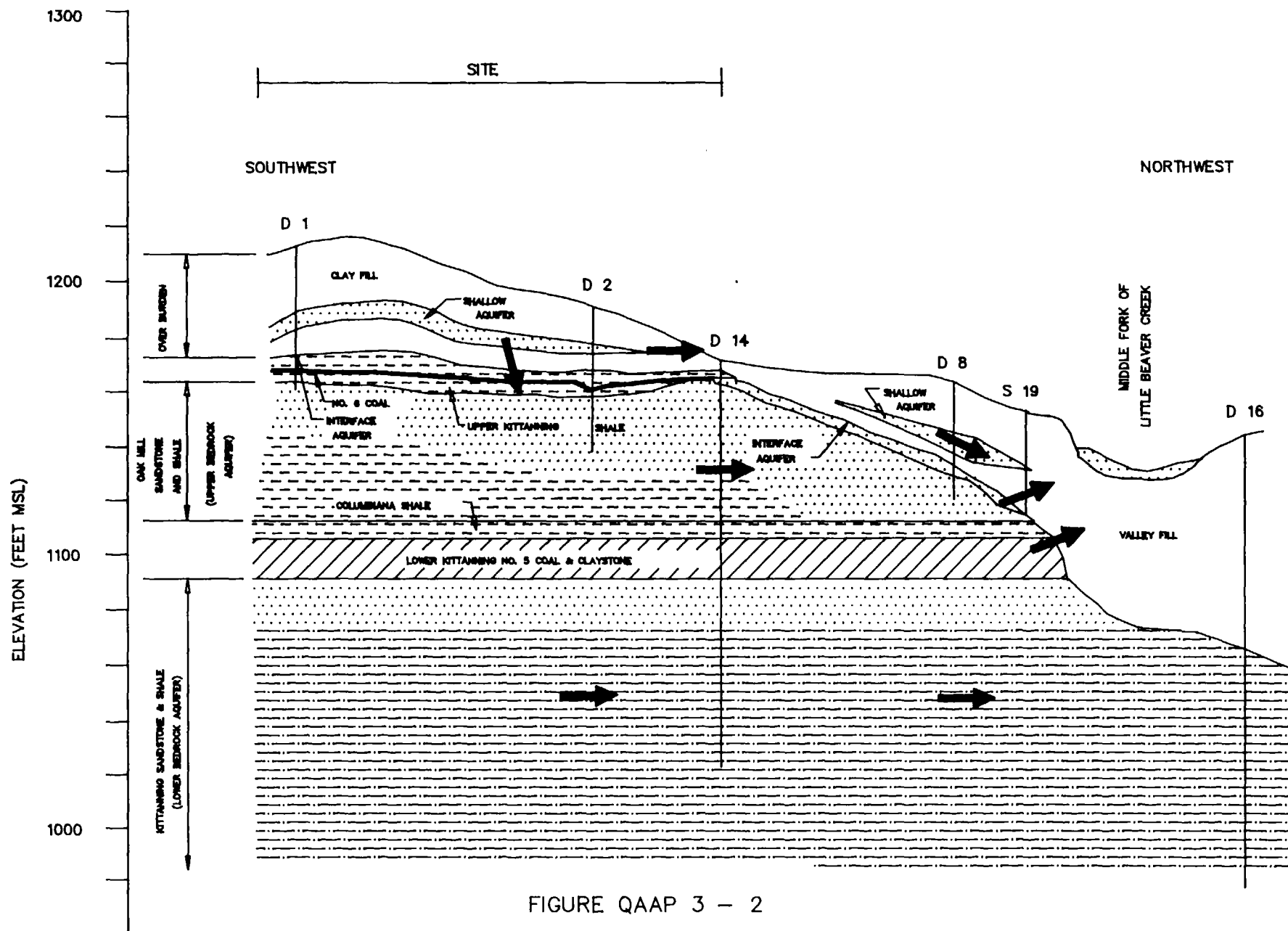
stormwater drains in a northeasterly direction to the main surface water body in the area, the Middle Fork Little Beaver Creek (MFLBC), which flows northward and then southward to Little Beaver Creek which eventually flows into the Ohio River. There is an inactive landfill located approximately 1,200 feet east of the site along the west bank of the MFLBC. This was operated as a dump and extends from the MFLBC to the east side of Allen Road. The area is presently covered with vegetation and construction rubble.

The area's potable water supply is provided by both a public water system and private wells. The small businesses along Allen Road receive drinking water from the City of Salem, although Dunlap Disposal uses well water for non-potable purposes. Residents along State Route 14A and further north on Allen Road and Goshen Road use either public water or private wells. The City of Salem has a reservoir which draws water from Cold Run Creek, approximately seven miles south of the Site.

The area is underlain by glacial deposits of the Kent Moraine, a five to fifteen mile wide belt of nonhomogeneous glacial drift. Approximately 10 to 25 feet of drift underlies the Site (Figure 3-2). This drift consists mostly of silty or sandy, gray-blue, plastic clay with some pebbles and boulders. Sand and gravel deposits within the drift have permeabilities higher than that of the silty or sandy clays. The drift is underlain by sedimentary rocks consisting mainly of interbedded sandstones, shales and coal seams.

Prior to drift deposition, glacial forces eroded a valley into the sedimentary rocks east of the Site. This eroded valley was filled as drift was deposited.

The distinct aquifers within the study area have been named the Shallow, Interface, Upper Bedrock, Lower Bedrock



and Valley Fill. Both confined and unconfined conditions are found in the area. Ground water beneath the Site apparently is moving in the general direction of the MFLBC. Hydrogeologic conditions near the MFLBC and within the Valley Fill have not been fully delineated.

3.1.2 History

From 1961 until 1973, Nease Chemical Company produced chemicals such as household cleaning compounds, pesticides, fire retardants, and chemical intermediates at the Site. Products and chemical intermediates were produced in batch processes.

Nease's waste handling facilities included air scrubbers and a multiple pond/settling tank system for neutralization and treatment of acidic waste. Five unlined lagoons (1, 2, 3, 4, and 7) were used for treatment and storage of either acidic waste or lime slurries from waste neutralization. In 1969, a pipeline was constructed to carry neutralized wastewater to the Salem Wastewater Treatment Plant. Some 55-gallon drums containing wastes were buried on-site in Exclusion Area A.

Following notification from OEPA of wastewater violations, Nease Chemical Company agreed in a Consent Judgment in 1973, to discontinue manufacturing operations at the Site until such time as a new wastewater permit was obtained. Instead, Nease decided to close the facility. Pond water was neutralized and removed to the Salem Wastewater Treatment Plant. Nease also filled/graded several ponds, and removed all production facilities with the exception of a warehouse and two small block buildings. On December 30, 1977, Nease merged with Ruetgers Chemicals, Inc. to form Ruetgers-Nease Chemical Company, Inc.

Since 1982, various environmental investigations and remedial actions have been conducted by Ruetgers-Nease at the Site. The objectives of these studies were to define hydrogeological conditions, identify potential migration of contaminants, and evaluate remedies. In 1983, the Site was placed on the National Priorities List (NPL). Investigation activities conducted by Ruetgers-Nease to date have included:

1. Soil borings and test pit excavations to characterize on-site contamination
2. Soil borings through ponds to characterize contaminant concentrations and quantities
3. Geophysical surveys at Exclusion Areas A and B to locate drum burial areas
4. Sediment and surface water sampling and analysis to identify contaminant migration and extent. Feeder Creek, the Crane-Deming Swamp, Slanker Pond, and MFLBC surface water and sediments have been sampled. In addition, U.S. EPA and OEPA have sampled fish from MFLBC and Slanker Pond
5. Air monitoring to evaluate on-site and off-site atmospheric releases
6. Installing and sampling monitoring wells and sampling nearby residential wells. At present, there are 38 monitoring wells at the Site, including:
 - o Fourteen Shallow Aquifer wells
 - o Six Interface Aquifer wells

- o Fourteen Upper Bedrock Aquifer wells
- o Four Lower Bedrock Aquifer wells

Three of these wells are installed into or through the Valley Fill.

7. Conducting a Risk Assessment in 1986
8. Completing a site grid system based on two sets of perpendicular lines with adjacent lines 100 feet apart

Table 3-1 lists compounds qualitatively identified at the Site. Most analyses were targeted to volatile and other organic compounds handled on-site. Several priority pollutant scans have been completed.

Remedial actions taken to date include:

1. Removing 115 buried drums from Exclusion Area A
2. Excavating and removing contaminated soils including approximately:
 - o 5,400 yd.³ from Exclusion Area A
 - o 684 yd.³ from Exclusion Area B
 - o 2,790 yd.³ from Pond 1
 - o 630 yd.³ from the ditch paralleling the south side of the railroad tracks
3. Seeding of Pond 2

QAPP TABLE 3-1

COMPOUNDS THAT HAVE BEEN QUALITATIVELY IDENTIFIED
AT THE RUETGERS-NEASE SALEM SITE PRIOR TO THE RI/FS

<u>Compounds</u>	<u>Range of MDLs</u> <u>Solid</u>	<u>Range of MDLs</u> <u>Aqueous</u>
1,1-Dichloroethene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
1,2-Dichloroethene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
Chloroform	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
1,2-Dichloroethane	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
1,1,1-Trichloroethane	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
1,2-Dichloropropane	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
1,3-Dichloropropene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
Trichloroethene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
Benzene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
Tetrachloroethene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
1,1,2,2-Tetrachloroethane	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
Toluene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
Chlorobenzene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
Ethylbenzene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
o,m,p-Xylene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
1,3+1,2-Dichlorobenzene	50-100 ug/kg ¹	0.5-1.0 ug/L ¹
Methoxychlor	50 ug/kg ^{2,3}	0.005 ug/L ² - 0.05 ug/L ³
Mirex	50 ug/kg ^{2,3}	0.005 ug/L ² - 0.05 ug/L ³
3,4-Dichloronitrobenzene	500 ug/kg ³ - 1000 ug/kg ¹	50 ug/L ³ - 200 ug/L ¹
Diphenyl Sulfone	500 ug/kg ³ - 1,000 ug/kg ¹	50 ug/L ³ - 200 ug/L ¹

NOTES

MDL - Method Detection Limit

¹By GC/FID

²By GC/ECD

³By GC/MS (SIM)

4. Installing geotextile fabric barriers and rock dams across drainage swales and ditches
5. Installing hay-bale barriers around the exclusion areas
6. Completing a leachate collection system between the railroad tracks and Exclusion Area A. Leachate is collected on a regular basis and disposed at a permitted off-site wastewater treatment facility.
7. Installed a fence surrounding the western portion of the Site.

These actions were taken by Ruetgers-Nease.

3.1.3 Existing Conditions

Currently, the Site contains a single-story warehouse; two small concrete-block buildings; concrete pads, foundations, and tile floors remaining from the manufacturing facilities; concrete tank saddles; and the pond areas. The Site west of the Conrail tracks is surrounded by a fence with access from Route 14. Much of the Site has been revegetated by weeds and grasses.

The banks of Pond 1 slope steeply to the water surface, which is about eight to ten feet below grade. The surface of Pond 2 contains isolated patches of grasses and weeds surrounded by barren areas. The surfaces of Pond 3, 4 and 7 consist of weeds, grasses, small shrubs and some small trees. A soil/sludge pile west of Pond 1 is covered by weeds, grasses, shrubs and small trees, and is approximately five to eight feet above the grade. The surfaces of Ponds 3 and 7 may not support heavy equipment.

The remainder of the study area contains large fields, stands of trees, plowed fields, houses and buildings. The Crane-Deming swamp contains areas of bare soils, and wetland grasses. Trees and dense vegetation border the MFLBC.

3.2 Problem Statement

Previous studies have identified sources on-site and have indicated that contaminant migration off-site may be occurring. This RI approach has been developed, in part, to identify all sources, characterize contaminants, and determine the limits of contaminant migration. A description of known sources, affected media, and the rationale for sampling are provided in the following sections.

3.2.1 Sources

Potential sources of contamination at the Site are listed in Table 3-2. The actual contribution of sources to affected media has not been quantified. The complete set of contaminants migrating from these sources has not been confirmed by samples meeting U.S. EPA QA-QC guidelines.

3.2.2 Affected Media

Previous studies have identified contaminants in various media. Media affected or potentially affected are listed on Table 3-3.

3.3 Project Objectives

The project objectives described in this section define the purpose of the Remedial Investigation/Feasibility Study

QAPP TABLE 3-2

POTENTIAL CONTAMINANT SOURCES⁽¹⁾
RUETGERS-NEASE SALEM SITE RI/FS

<u>Source</u>	<u>Characterization</u>
Exclusion Areas A and B	Some buried drums and contaminated soils (removed) contained volatile and non-volatile organics.
Pond 1, 2	Disposal of treated process waters containing volatile organic compounds in non-secure/unlined areas (some Pond 1 soil removed).
Ponds 3,4,7	Contaminants, if present in soil/sludge stockpile neutralized calcium sulfate sludge, may migrate through unlined pond bottoms or in surface runoff.
Manufacturing areas, on-site surface and subsurface soils	Possible chemical spills may have contaminated soils.

(1) Based on sampling by Ruetgers-Nease performed to date. Confirming and characterizing sources is an objective of the RI.

QAPP TABLE 3-3

AFFECTED OR POTENTIALLY AFFECTED MEDIA
RUETGERS-NEASE SALEM RI/FS

<u>Media</u>	<u>Location</u>	<u>Potential Contaminants</u>
Surface Water	Feeder Creek ⁽¹⁾	Volatile Organics Non-Volatile Organics Additional Organics
	MFLBC ⁽¹⁾	Volatile Organics Non-Volatile Organics Additional Organics
Sediments	Feeder Creek ⁽¹⁾	Volatile Organics Non-Volatile Organics Additional Organics
	MFLBC ⁽¹⁾	Volatile Organics Non-Volatile Organics Additional Organics
	Slanker Pond ⁽¹⁾	Non-Volatile Organics Additional Organics
	Crane-Deming ⁽¹⁾ Swamp	Volatile Organics Non-Volatile Organics Additional Organics
Fish	MFLBC ⁽²⁾	Non-Volatile Organics Additional Organics
Soils	On-Site ⁽¹⁾	Volatile Organics Non-Volatile Organics Additional Organics
Sludges	Salem Wastewater Treatment Plant Sludge Cells 4, 6 and 8 ⁽²⁾	Volatile Organics Non-Volatile Organics Additional Organics

(1) Based on sampling by Ruetgers-Nease performed to date.

(2) Ruetgers-Nease has not sampled these locations.

(3) This aquifer may, or may not exist down gradient of the site.

*Non-Volatile Organics are defined here and throughout the document as TCL BNA +25, TCL pesticides/PCBs

QAPP TABLE 3-3 (Cont'd)

AFFECTED OR POTENTIALLY AFFECTED MEDIA
RUETGERS-NEASE SALEM RI/FS

<u>Media</u>	<u>Location</u>	<u>Potential Contaminants</u>
Ground Water	Shallow ⁽¹⁾ Aquifer	Volatile Organics Non-Volatile Organics Additional Organics
	Interface ⁽¹⁾ Aquifer	Volatile Organics Non-Volatile Organics Additional Organics
	Upper Bedrock ⁽¹⁾ Aquifer	Volatile Organics Non-Volatile Organics Additional Organics
	Lower Bedrock ⁽¹⁾ Aquifer	Volatile Organics Non-Volatile Organics Additional Organics
	Valley Fill ⁽²⁾⁽³⁾ Aquifer	Volatile Organics Non-Volatile Organics Additional Organics

(1) Based on sampling by Ruetgers-Nease performed to date.

(2) Ruetgers-Nease has not sampled these locations.

(3) This aquifer may, or may not exist down gradient of the site.

*Non-Volatile Organics are defined here and throughout the document as TCL BNA +25, TCL pesticides/PCBs

(RI/FS) being conducted. The objectives of the RI/FS are to gather data of adequate technical content, quality and quantity to:

- o Determine fully the fact, nature, extent and magnitude of contamination on and off the Site.
- o Determine if contaminants relating to the Ruetgers-Nease Site pose a threat to human health or the environment through the development of an Endangerment Assessment.
- o Fully identify and characterize the source, migration pathways, routes of entry and receptors for contaminants.
- o Support the identification, development and evaluation of remedial alternatives during the FS, an Endangerment Assessment, remedial technology screening, alternative development and screening, and detailed alternative evaluation.

The project data quality objectives for analytical laboratory data and field measurements are presented in Section 5 of this QAPP.

3.4 Time Schedule

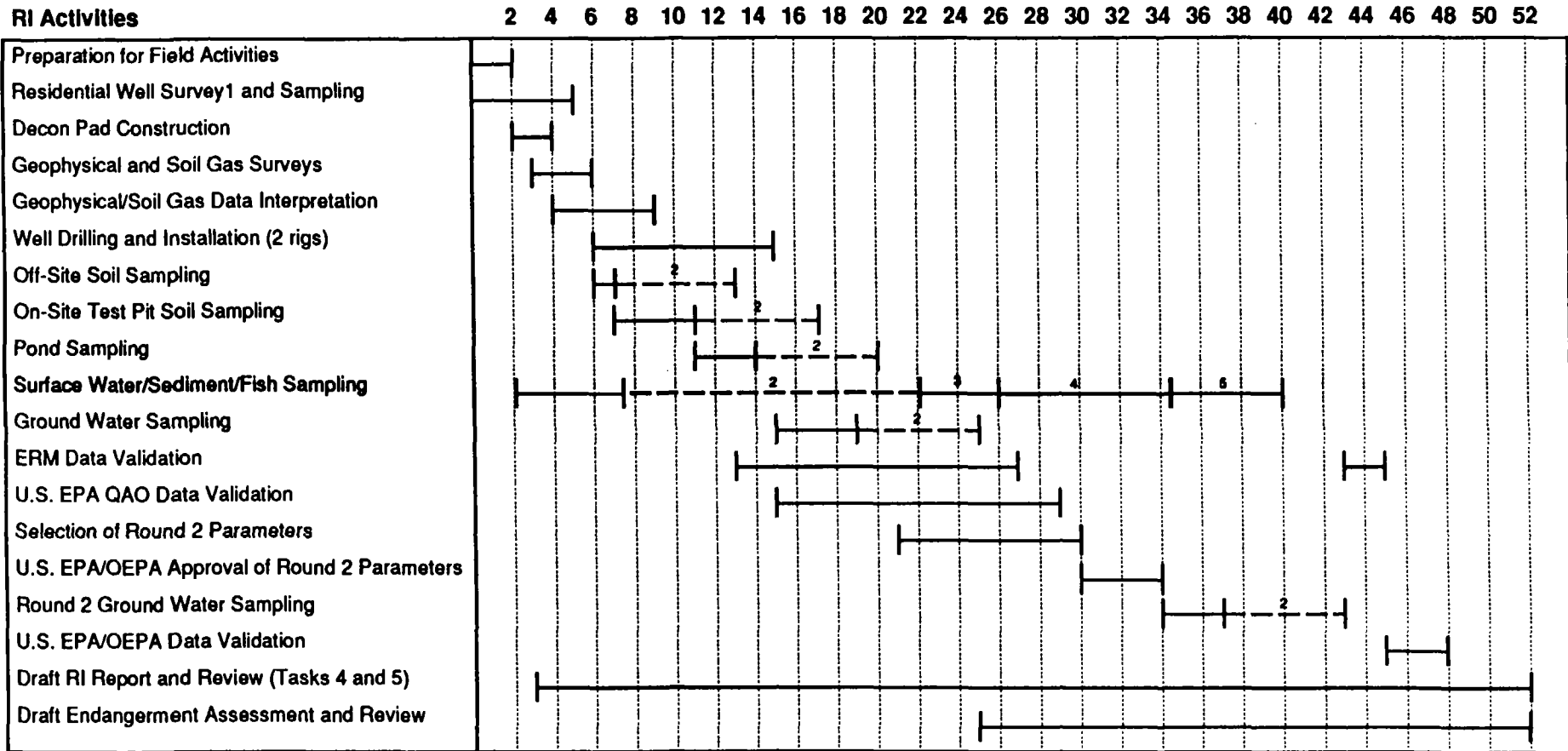
3.4.1 ERM's Time Schedule

The time schedule for the implementation of RI activities is presented in Figure 3-3.

FIGURE QAPP 3-3

Schedule for Implementation of RI Activities at the Ruetgers-Nease Salem Site RI/FS

Weeks from
Work Plan Approval



1. 1/2 mile radius confirmation of 1 mile radius search, residential well sampling
2. Laboratory analysis time
3. ERM data validation for surface water/sediment/fish sample analyses
4. U.S. EPA QAO data validation for surface water/sediment/fish sample analyses
5. Preparation of technical memorandum concerning surface water/sediment/fish sample analytical results

NOTE: Start-up and completion dates may change depending on field conditions

REVISED 12.89
ERM-MIDWEST, INC

VOLUME 2 : QAPP
SECTION: 3
REV.4/Feb.1990

QAPP-15

3.4.2 Enseco's Time Schedule

Sample delivery groups will be organized into "Cases". One Case will consist of all samples received at Enseco Laboratory within a one week period.

Data turnaround time will be four weeks from the date on which the last sample in the Case is received.

3.5 Intended Data Use

The data collected during the RI will be used to meet the project objectives specified in Section 3.3. Soil, sediment, surface water, ground water, fish and air sample data will be used to evaluate the current public health risks related to the site in the Endangerment Assessment. The data will be carefully selected and applied to assure that data used for this purpose is of suitable quality.

At a minimum, all sampling and off-site analysis data will be consistent with EPA's CLP (Contract Laboratory Program) specifications CLP SOW-7/87. QA objectives (accuracy, precision, sensitivity), which are more stringent than CLP, are required for the interpretation of data representing ground water and surface water for those samples specified as critical. More sensitive methods will be used to analyze fish and air matrices for organic constituents in an attempt to meet levels of health-based criteria.

In addition to the off-site analysis, there will also be on-site field measurements performed utilizing HNU, OVA and pH meters. The OVA and HNU data will be used for health and safety purposes by determining the levels of volatile organic constituents in and around areas of the site. The OVA and HNU data will also be used as part of the soil gas survey to

semi-quantitatively determine the levels of volatile organic constituents present in subsurface soils. This screening will be utilized as an aid in the selection process as to which samples will be submitted for off-site analyses. This selection process will be based upon a comparison of gross instrument responses. The pH data will be used as a field indicator of groundwater quality (as compared to background sample pH readings), and for determining the stability of groundwater with respect to a properly purged groundwater system. This determination will be based upon a comparison of pH readings during the purging process. The pH data for surface water will be used as an indication of the ambient water quality as it pertains to supporting freshwater aquatic life.

A majority of the samples collected at the Site will be analyzed to produce data of sufficient quality to evaluate the extent of contamination. For this application, CLP procedures and QA objectives are sufficient. When CLP criteria are not met due to a variety of sample matrix related reasons, the data will be carefully evaluated to determine if certain aspects of this data can still be used to meet the project objectives.

3.6 Sample Network and Rationale

Sample locations and analysis have been identified that will provide data necessary to meet the objectives of the RI/FS and to complete EA activities. The sample network rationale collection method and type of information needed are listed on Table 3-4. Samples considered critical to achieving project objectives, and a summary of activities to ensure these samples meet QA/QC criteria are listed on Table 3-5.

QAPP TABLE 3-4

SAMPLING RATIONALE
RUETGERS-NEASE SALEM SITE RI/FS

<u>Information Needed</u>	<u>Rationale</u>	<u>Data Gathering Methods</u>
1. Characteristics of on-site surface and subsurface soils.	1. On site soil contaminant distribution - horizontal and vertical 2. Determine contaminant concentrations, migration pathways and routes of entry in order to complete an Endangerment Assessment 3. Support the identification, development, and evaluation of remedial alternatives/ technology screening, and detailed alternative evaluation completed during the Feasibility Study.	Test pits, analysis of samples from side walls of pits and backhoe bucket
2. Characteristics of off-site surface and subsurface soils in the Crane-Deming Swamp.	1. Contaminant distribution in the Crane-Deming Swamp - horizontal and vertical 2. Determine contaminant concentrations, migration pathways and routes of entry in order to complete an Endangerment Assessment 3. Support the identification, development, and evaluation of remedial alternatives/ technology screening, and detailed alternative evaluation completed during the Feasibility Study.	Test pits, analysis of samples from side walls of pits and backhoe bucket

QAPP TABLE 3-4 (cont'd)

SAMPLING RATIONALE
RUETGERS-NEASE SALEM SITE RI/FS

<u>Information Needed</u>	<u>Rationale</u>	<u>Data Gathering Methods</u>
3. Characteristics of on-site Non-native Pond materials.	1. Pond contaminant distribution - vertical and horizontal 2. Non-native material physical characterization 3. Determine contaminant concentrations, migration pathways and routes of entry in order to complete an Endangerment Assessment 4. Support the identification, development, and evaluation of remedial alternatives/ technology screening, and detailed alternative evaluation completed during the Feasibility Study.	Soil borings, sampling and analysis of split spoon and shelby tube samples
4. Characteristics of Native Pond materials (soils under the pond bottom).	1. Pond contaminant distribution - vertical horizontal 2. Native material physical characterization 3. Determine contaminant concentrations, migration pathways and routes of entry in order to complete an Endangerment Assessment	Soil borings, sampling and analysis of split spoon and shelby tube samples

QAPP TABLE 3-4 (cont'd)

SAMPLING RATIONALE
RUETGERS-NEASE SALEM SITE RI/FS

<u>Information Needed</u>	<u>Rationale</u>	<u>Data Gathering Methods</u>
	4. Support the identification, development, and evaluation of remedial alternatives/technology, and detailed alternative evaluation completed during the Feasibility Study.	
5. Characteristics of off-site surface and subsurface soils.	1. Off-site soil contaminant distribution 2. Determine contaminant concentrations, migration pathways and routes of entry in order to complete an Endangerment Assessment 3. Support the identification, development, and evaluation of remedial alternatives/technology screening, and detailed alternative evaluation completed during the Feasibility Study.	Soil borings, sampling and analysis of split spoon or auger samples
6. Characteristics of on and off-site sediments.	1. Sediment contaminant distribution - horizontal - within the drainage ways, Feeder Creek, Slanker Pond and MFLBC	Collection and analysis of location specific surface sediments

QAPP TABLE 3-4 (cont'd)

SAMPLING RATIONALE
RUETGERS-NEASE SALEM SITE RI/FS

<u>Information Needed</u>	<u>Rationale</u>	<u>Data Gathering Methods</u>
	2. Determine contaminant concentrations, migration pathways and routes of entry in order to complete an Endangerment Assessment 3. Support the identification, development, and evaluation of remedial alternatives/technology screening, and detailed alternative evaluation completed during the Feasibility Study.	
7. Characteristics of on and off-site surface water bodies	1. Contaminant distribution - horizontal - within the drainage ways, Feeder Creek, Slanker Pond and MFLBC 2. Determine contaminant concentrations, migration pathways and routes of entry in order to complete an Endangerment Assessment 3. Support the identification, development, and evaluation of remedial alternatives/technology screening, and detailed alternative evaluation completed during the Feasibility Study.	Collection and analysis of location specific surface water samples

QAPP TABLE 3-4 (cont'd)

SAMPLING RATIONALE
RUETGERS-NEASE SALEM SITE RI/FS

<u>Information Needed</u>	<u>Rationale</u>	<u>Data Gathering Methods</u>
8. Characteristics of on and off-site ground water	<ol style="list-style-type: none"> 1. Contaminant distribution - horizontal and vertical aquifers 2. Determine contaminant concentrations, migration pathways and routes of entry in order to complete an Endangerment Assessment 3. Support the identification, development, and evaluation of remedial alternatives/ technology screening, and detailed alternative evaluation completed during the Feasibility Study. 	Sampling and analysis of monitoring and residential wells
9. Air monitoring station upwind and downwind of the site	<ol style="list-style-type: none"> 1. Define areal extent of contaminant concentrations 2. Determine contaminant concentrations, migration pathways and routes of entry in order to complete an Endangerment Assessment 3. Support the identification, development, and evaluation of remedial alternatives/ technology screening, and detailed alternative evaluation completed during the Feasibility Study. 	Sampling and analysis of 6 stations

QAPP TABLE 3-4 (cont'd)

SAMPLING RATIONALE
RUETGERS-NEASE SALEM SITE RI/FS

<u>Information Needed</u>	<u>Rationale</u>	<u>Data Gathering Methods</u>
10. Mapping and surveying	1. Locate existing structures and obstructions for alternatives evaluation, site features, and topography description	Site survey, site inspections, existing and updated facility maps

QAPP TABLE 3-5

CRITICAL SAMPLE SUMMARY
RUETGERS-NEASE SALEN SITE RI/FS

<u>Sample Location</u>	<u>Media</u>	<u>Rationale</u>	<u>Activity</u>
Well Cluster "1"	Ground Water	1) Determine existing background water quality at the site. 2) Provide basis for remediation levels.	1) Collect collocated sample from one well. 2) Complete two sample events. 3) 100% ⁽¹⁾ completeness goal. 4) SAS low detection levels. (See Section 9)
Residential Wells	Ground Water	1) Ensure acceptable drinking water quality.	1) Collect two collocated samples during each sampling event. 2) 100% ⁽¹⁾ completeness goal. 3) SAS low detection levels. (See Section 9)
MFLBC 1	Surface Water	1) Define background water quality conditions in MFLBC.	1) Collect one collocated sample at the upgradient location. 2) 100% ⁽¹⁾ completeness goal 3) SAS low detection levels. (See Section 9)
Off-Site Soil (background)	Soil	1) Define natural or background soil conditions. 2) Provide remedial design Data	1) One collocated sample from one boring. 2) 100% ⁽¹⁾ completeness goal.
MFLBC 1	Fish	1) Define background conditions	1) 100% ⁽¹⁾ completeness goal.
Sl tanker Pond	Surface Water	1) Ensure acceptable water quality	1) 100% ⁽¹⁾ completeness goal.

(1) Data with <100% completeness will be acceptable as long as the deficiency does not hinder project objectives.

QAPP-24

Target Compound List (TCL) analysis (organic and inorganic) will be conducted using Contract Laboratory Program (CLP) procedures. The analysis of DCNB and DPS will also be analyzed using CLP procedures since these compounds are amendable to the semivolatile analytical protocol. Methods will be developed and validated for mirex, kepone and photomirex, which are not on the TCL. Methods development and validation study design and its completion will both be submitted for U.S. EPA and OEPA approval before investigation activities begin. Dioxins and furans will be analyzed by U.S. EPA PCDF/PCDD protocol, exhibit D, analytical methods, draft April 19, 1989 and revised in November 1989. If tetrachlorodioxins are found, the extract will be analyzed for 2,3,7,8-TCDD by EPA CLP SOW 8/87.

3.7 Monitoring Parameters and Frequency of Collection

The locations where investigative samples are to be collected as well as the types, frequency of collection, and analytical parameters are provided in Table 3-6. It should be noted that the number of soil samples and associated QA/QC samples collected at the on-site and off-site locations are dependent on the variables described in the Site Specific Sampling Plan. Sampling locations are shown in Figures 3-4 through 3-7. Sample locations shown on Figure 3-6 and 3-7 are described on Table 3-7.

**QAPP TABLE 3-6
ESTIMATED RI SAMPLING SUMMARY¹
RUETGERS-NEASE SALEM SITE**

Matrix	Sample Location	Investigative Samples	Number of	Chemical Analysis ²								Number of Field QA/QC Samples ³		Matrix
				A	B	C	D	E	F	G	H	I	Field Duplicates/Replicates	Field Blanks
Soil	35 Test Pits ⁵	105	87	18								11	6	122
	2 Pond 1 Borings ⁵	8			6	2						1	1	10
	4 Pond 2 Borings ⁵	15			9	3	8					2	1	18
	4 Pond 3 Borings ⁶	15			9	3	3					2	1	18
	3 Pond 4 Borings ⁵	12			6	3	3					1	1	14
	5 Pond 7 Borings ⁷	21			12	6	3					2	2	25
	11 Off-Site Soil Borings ⁸	22			22							2	2	26
	7 MFLBC Flood plain soil stations	28							28			3	2	33
Non-Native Material	2 Pond 1 Borings ⁵	6	3	3								1		7
	4 Pond 2 Borings ⁵	9	4	2			3					1	1	11
	4 Pond 3 Borings ⁷	4	2	1			1							4
	3 Pond 4 Borings ⁵	9	3	3			3					1		10
	5 Pond 7 Borings ⁶	10	4	4			2					1	1	12
	Sludge/soil (Salem Treatment Plant)	3								3		1	1	5
Sediment	MFLBC, Feeder Crk, Slanker Pond, Crane Deming	61	14			22		18	7			7	4	72
Water	Ground Water Monitoring Wells ⁹	66	62	4								7	4	77
	Ground Water Residential Wells ¹⁰	6		6								1	1	8
	28 Surface Water Stations	26	12			14						3	3	32
Fish	MFLBC, Slanker Pond	56 ¹¹	10			46						6		62
Air ¹²	6 Stations	6	6									1	1	8
Total: 574 ¹³														

¹ Contingency analyses have not been included in this table.

² A=TCL volatile organics (+15), TCL nonvolatile (+25), mirex, kepone, photomirex, DPS.*

B=TCL organics (+40), TCL inorganics, mirex, kepone, photomirex, DPS,* dioxins and furans, 3,4-DCNB*.

C=TCL volatile organics (+15) mirex, kepone, photomirex, methoxychlor, DPS.*

D=TCL nonvolatile organics (+25), mirex, kepone, photomirex, DPS.*

E=TCL nonvolatile organics (+25).

F=Physical parameters: soil classification, specific gravity, permeability, effective porosity, particle size, moisture content, and Atterburg Limits.

G=Mirex, kepone, photomirex, DPS

H=Mirex, Kepone, photomirex, DPS & methoxychlor

I=TCL organics (+40), TCL inorganics, mirex, kepone, photomirex, DPS,*3,4-DCNB*.

* 3,4-Dichloronitrobenzene (DCNB)* and Diphenylsulfone (DPS) will be analyzed as part of the semivolatile fraction.

³ Frequency of field QA/QC sample collection:

Replicates/Duplicates—1 per 10 samples per matrix.

Field Blanks—1 per 10 samples for surface water samples and 1 per 20 samples for groundwater/solid/air samples. The 1 per 20 samples for field blanks apply to groundwater because dedicated sampling equipment will be utilized for the collection of samples from each monitoring well. (Note: for the submission of aliquots for laboratory MS/MSD, triple volume is required for VOAs and double volume is required for all other analyses.)

⁴ Trip blanks will be submitted one per cooler containing aqueous samples for VOA analysis and one per 20 solid/air samples for VOA analysis.

⁵ This number of samples assumes that test pits will be sampled to 6.5 feet below ground surface.

⁶ This number of samples assumes that boring(s) will be sampled to a 12-foot depth and will have 3 feet of non-native material.

⁷ This number of samples assumes that boring(s) will be sampled to a 15-foot depth and will have 6 feet of non-native material.

⁸ This number of samples assumes that boring(s) will be sampled to a 3.5-foot depth.

⁹ This number includes only Round 1 groundwater samples.

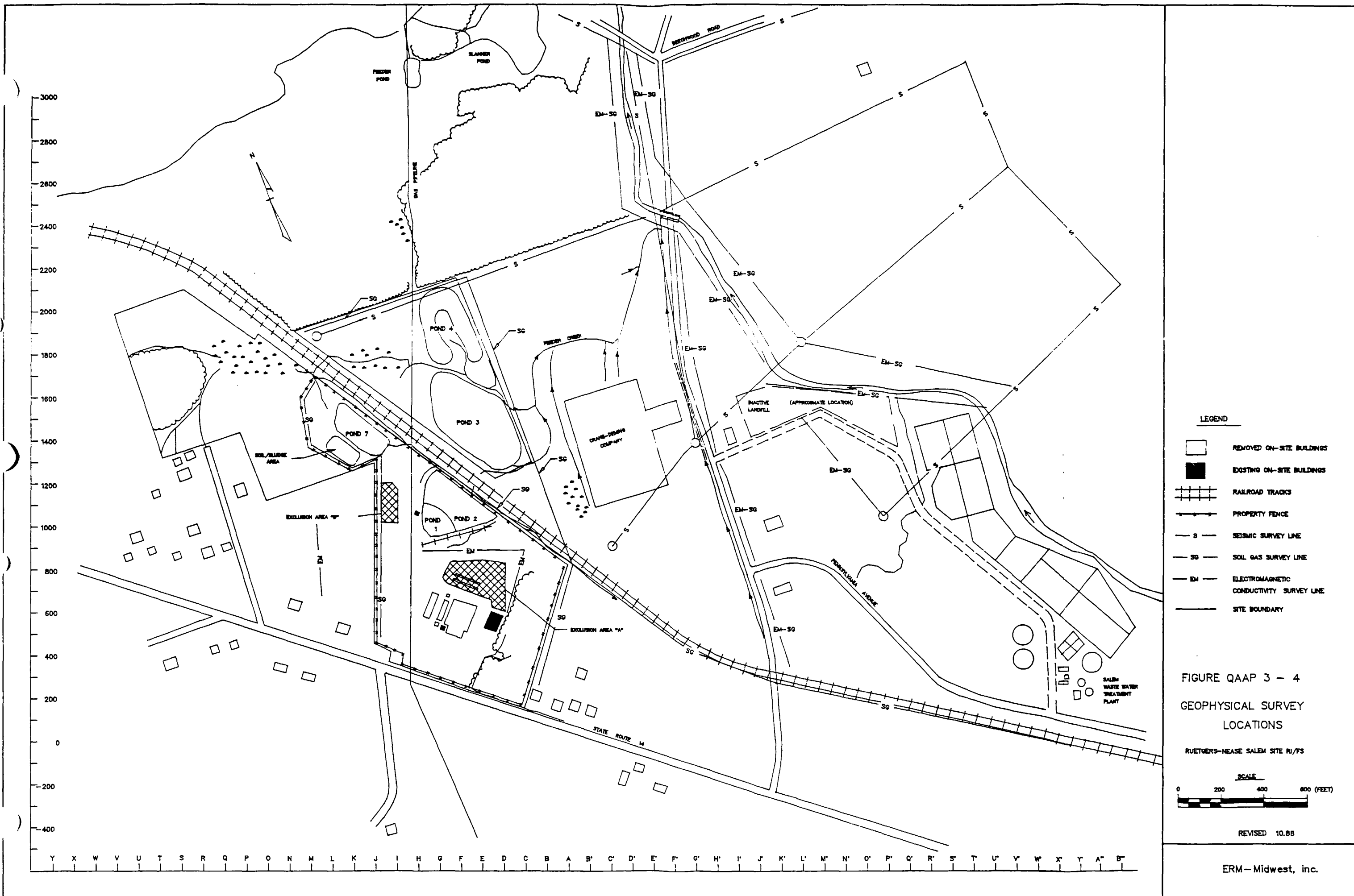
¹⁰ Double the normal sampling volume will be required for residential well analyses.

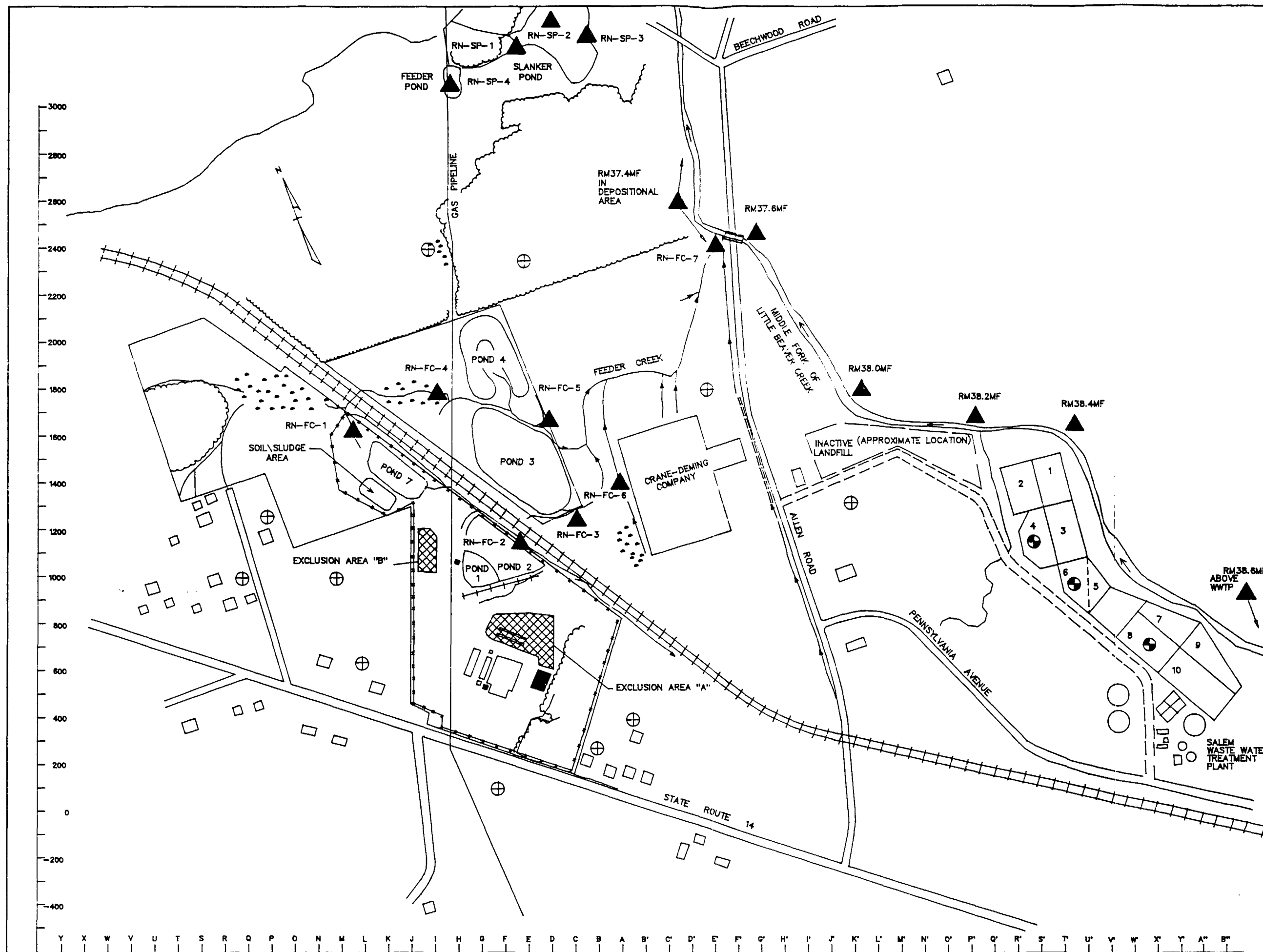
¹¹ 2 at Slanker, 54 in MFLBC

¹² The volatile analysis of air samples will be the TCL VOA +15 minus the 4 Kepones on the VOA TCL.

¹³ This total does not include trip blanks

NOTE: Matrix total does not include laboratory sampling.





NOTE:
MFLBC-1 THROUGH 6 DESCRIBED
ON TABLE 5.
OTHER SAMPLES DESCRIBED
ON TABLE 4.

LEGEND

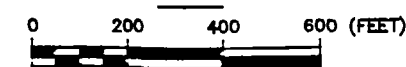
- REMOVED ON-SITE BUILDINGS
- EXISTING ON-SITE BUILDINGS
- RAILROAD TRACKS
- PROPERTY FENCE
- STREAM (DRAINAGE)
POND SAMPLING STATION
- OFFSITE SOIL SAMPLE
- SITE BOUNDARY
- SALEM WWTP
SLUDGE SAMPLE
- CELL NUMBERS

FIGURE QAAP 3 - 6

SURFACE WATER,
SEDIMENT AND OFF-SITE
SOIL SAMPLES

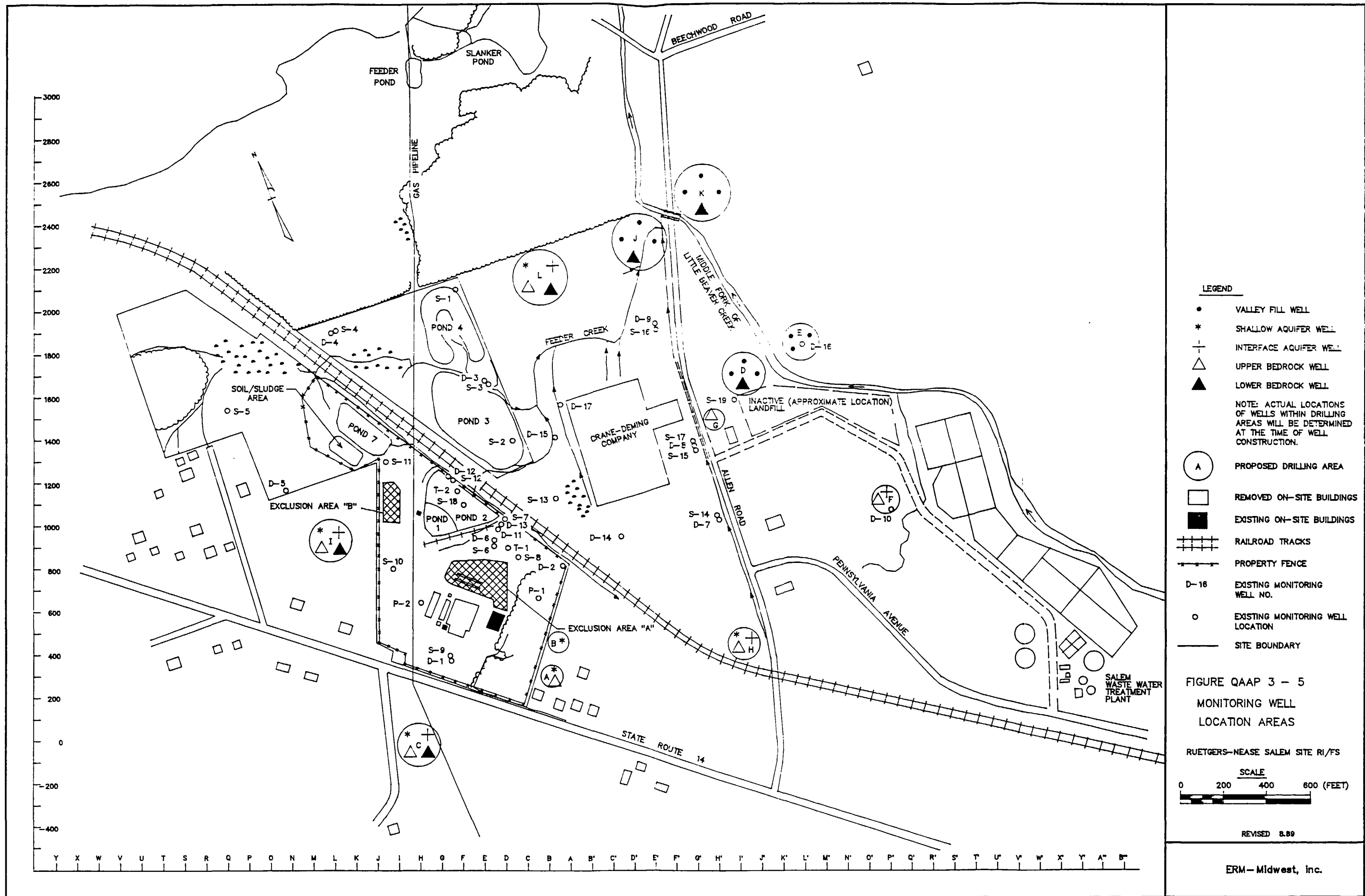
RUETERS-NEASE SALEM SITE RI/FS

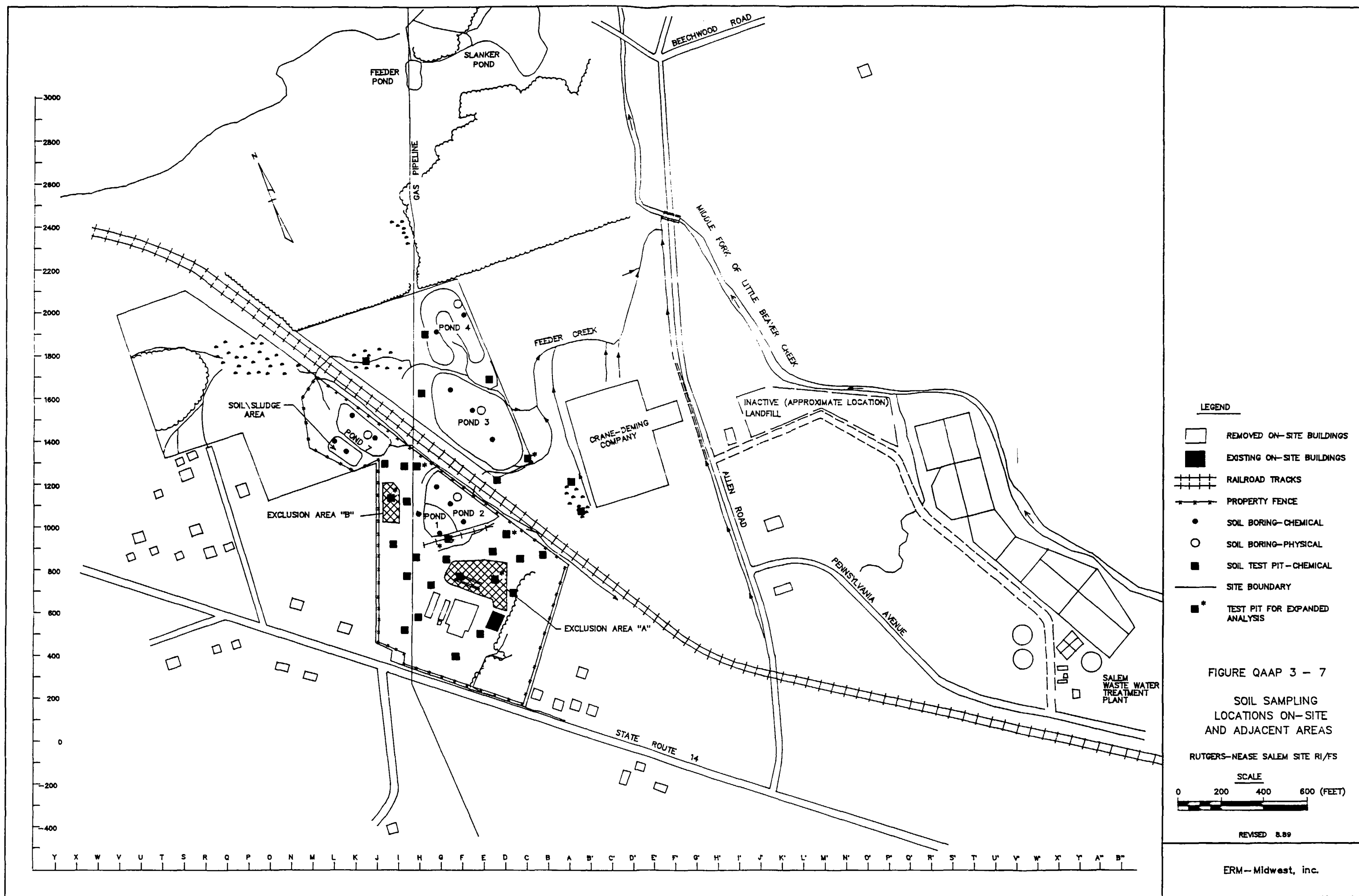
SCALE



REVISED 8.89

ERM-Midwest, Inc.





QAPP TABLE 3-7
Sampling Program for Survey of Feeder Creek, Slanker Pond, and Middle Fork of Little Beaver Creek

Description	Station	5/16/89 Agreed Location No.	Analysis							
			Media				Parameters			
			F	SW	S	FP	CLP +40	CLP Non- Vol +25	M, P, K, DPS	M, P, K, DPS, ME
Upstream of the WWTP as stream crosses Rte. 45	RM 38.6 MF	#1	2	1	1		4		4	0
NE corner WWTP	RM 38.4 MF	#2		1	1		2		2	0
Golf course stream	RM 38.2 MF	#3		1	1		2		2	0
Discharge zone	RM 38.0 MF	#4		1	1		2		2	0
Upstream Allen Road	RM 37.6 MF	#5	2	1	1		4		4	0
Feeder/Slanker Pond	RN - SP - 4	#6A			1				1	0
Slanker Pond, Inlet	RN - SP - 1	#6B			1				1	0
Slanker Pond, middle	RN - SP - 2	#6C	2	1	1		4		4	0
N. of Slanker Pond beach	RN - SP - 3	#6D			1				1	0
Allen Road downstream (Slanker Bridge, north)	RM 37.4 MF	#7	2	1	1		4		4	0
Pine Lake Road bridge	RM 36.7 MF	#8	2	1			3		3	0
Between Goshen Road and Rte. 165	RM 35.4 MF	#9	2					2	2	0
Miller Farm	RM 35.0 MF	#10			1	4		0	0	5
Swamp area 0.3 RM south of Middletown Road		#11			1			0	1	0
Ruthraff Farm	RM 33.3 MF	#12			1	4		0	0	5
Rte. 45 (0.7 mi. N of Middletown Road)	RM 32.0 MF	#13	2	1	1			4	4	0
Swamp area between Rte. 45 and Rte. 62		#14			1			0	1	0
Rte. 62		#15	2		1			3	3	0
Swamp area 0.45 RM south of Rte. 62		#16			1			0	1	0
Sherwood Farm		#17			1	4		0	0	5
Rte. 165		#18	2	1	1			4	4	0
Beaver dam 1.85 RM south of Rte. 165		#19			1			0	1	0
Large swamp are west of beaver dam		#19A			1	4		0	0	5
Large swamp are east of beaver dam (Shepherd dam)		#19B			1	4		0	0	5
Pine Lake Road bridge		#20	2	1	1			4	4	0
0.7 RM south of Pine Lake Road bridge		#21			1			0	1	0
Due east of intersection of E. 10th St. & Egypt Rd.		#22	2		1			3	3	0
Private bridge 0.45 RM south of Rte. 14 bridge		#23	2	1	1			4	4	0
N. Lisbon Rd-Rte. 14 at river bend	RM 24.5 MF	#24			1			0	1	0
Swamp area due west of EPA '89 station 24		#25			1			0	1	0
Swamp area 0.53 RM south of EPA '89 station 24		#26			1			0	1	0
Camp Farm		#27			1	4		0	0	5

KEY:

F = Fish
 SW = Surface Water
 S = Sediment

B = Benthos

FP = Floodplain Sediment

M = Mirex

P = Photomirex

K = Kepone

DPS = Diphenyl sulfone

ME = Methoxychlor

ASSUMPTIONS:

- 2 fish samples per station
- 4 floodplain samples per location

NOTES:

- No Station #36
- The analysis of CLP+40 and CLP non-volatile+25 includes the analysis of methoxychlor.

QAPP-31

QAPP TABLE 3-7
Sampling Program for Survey of Feeder Creek, Slanker Pond, and Middle Fork of Little Beaver Creek

Description	Station	5/16/89 Agreed Location No.	Analysis							
			Media				Parameters			
			F	SW	S	FP	CLP +40	CLP Non- Vol +25	M, P, K, DPS	M, P, K, DPS, ME
Railroad bridge over Lisbon-Canfield Road	RM 23.5 MF	#28	2	1	1			4	4	0
Cunningham Road bridge over Stone Mill Run	RM 2.0 SMR	#29	2	1	1			4	4	0
Erie-Lackawanna bridge over E. Branch Cherry Valley Run		#30	2	1	1			4	4	0
SE bank of confluence of MFLBC & Cherry Valley Cr.		#31			1			0	1	0
0.23 RM south of old Rte. 344 bridge		#32			1			0	1	0
Swamp area due west of EPA '89 station 32		#33			1			0	1	0
Swamp area 0.68 RM north of Rte. 45		#34			1			0	1	0
Teagarden bridge on Eagleton Road	RM 17.5 MF	#35	2	1	1			4	4	0
Coleman Road bridge	RM 15.1 MF	#37	2		1			3	3	0
0.37 RM south of Furnace Road bridge		#38			1			0	1	0
Above Lisbon dam	RM 12.5 MF	#39	2		1			3	3	0
Below Lisbon spillway	RM 12.5 MF	#40	2	1	1			4	4	0
0.6 RM west of EPA '89 station 42		#41			1			0	1	0
Elkton West Point Road bridge		#42	2	1	1			4	4	0
0.2 RM east of EPA '89 station 42		#43			1	4		0	0	5
Beaver Creek State Park canoe livery 2.25 mi. east of Elkton	RM 4.6 MF	#44	2		1			3	3	0
Beaver Hollow Road Bridge		#45	2		1			3	3	0
Swamp area by Rte. 7 north of Williamsport		#46			1			0	1	0
Y Camp Road bridge	RM 14.4 WB	#47	2	1	1			4	4	0
Bell School Road bridge	RM 14.4 LBC	#48	2	1	1			4	4	0
Sprucevale Bridge-Beaver Creek State Park	RM 11.0 LBC	#49	2		1			3	3	0
Fredricktown bridge	RM 0.2 LBC	#50	2	1	1			4	4	0
1 RM south of MFLBC/NFLBC confluence		#51	2		1			3	3	0
Grimms Road bridge gauging station	RM 4.5 LBC	#52	2	1	1			4	4	0
Feeder Creek NNW of Pond 7	RN-FC-1	#53			1		1		1	
Feeder Creek East of Pond 2	RN-FC-2	#54			1		1		1	
Feeder Creek S of Pond 3	RN-FC-3	#55		1	1		2		2	
Feeder Creek (Swamp) W of Pond 4	RN-FC-4	#56			1		1		1	
Feeder Creek S of Pond 4	RN-FC-5	#57		1	1		2		2	
Feeder Creek W of Crane-Deming	RN-FC-6	#58		1	1		2		2	
Feeder Creek Prior to entering MFLBC	RN-FC-7	#59		1	1		2		2	
Subtotal			56	26	61	28	36	82	136	35
Total			171				289			

KEY:

F = Fish
 SW = Surface Water
 S = Sediment

B = Benthos

FP = Floodplain Sediment

M = Mirex

P = Photomirex

K = Kepone

DPS = Diphenyl sulfone

ME = Methoxychlor

ASSUMPTIONS:

- 2 fish samples per station
- 4 floodplain samples per location

NOTES:

-No Station #36

-The analysis of CLP+40 and CLP non-volatile+25 includes the analysis of methoxychlor.

QAPP-32

VOLUME 2: QAPP
 SECTION: 3
 REV.4/Feb.1990

4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

QA/QC procedures must be strictly adhered to in order to ensure the production of the highest quality data. Several organizations will have responsibilities for implementing portions of this QAPP. Ruetgers-Nease owns the site. ERM-Midwest, Inc. has been retained to conduct most RI/FS activities. The ERCO Laboratory of Enseco will conduct chemical analyses of all samples except for dioxin and furan analysis, T01/T02 thermal desorption, and physical properties. Dioxin and furan analysis will be conducted at the California Analytical Laboratory of Enseco. The T01 and T02 thermal desorption VOA analyses will be conducted at the CRL/El Monte Air Toxics Laboratory of Enseco. GZA Laboratory of Newton, MA, will perform the analysis for the physical parameters in soils. Analytical data for this investigation will have two separate reviews for validity and usability. Enseco will validate the analytical data prior to release. ERM's Project QA/QC Manager will perform a rigorous validation to determine validity and fitness for use with appropriate qualifications. U.S. EPA and OEPA retain the option to conduct a final data review on any portion of the data within the appropriate period designated on Figure 3-3. The organization and responsibilities of individuals and organizations implementing the procedures specified in this QAPP are described in the following subsections.

4.1 Organization

The key individuals who are responsible for the overall coordination of efforts to be conducted, as well as the collection, validation, and interpretation of data generated during the RI are identified on Figure 4-1. Figure 4-2 identifies the structure of the Enseco Laboratory, where the majority of analyses will be performed. Figure 4-3 identifies

**Figure QAPP 4-1
Quality Assurance Project Organization
Ruetgers-Nease Salem Site RI/FS**

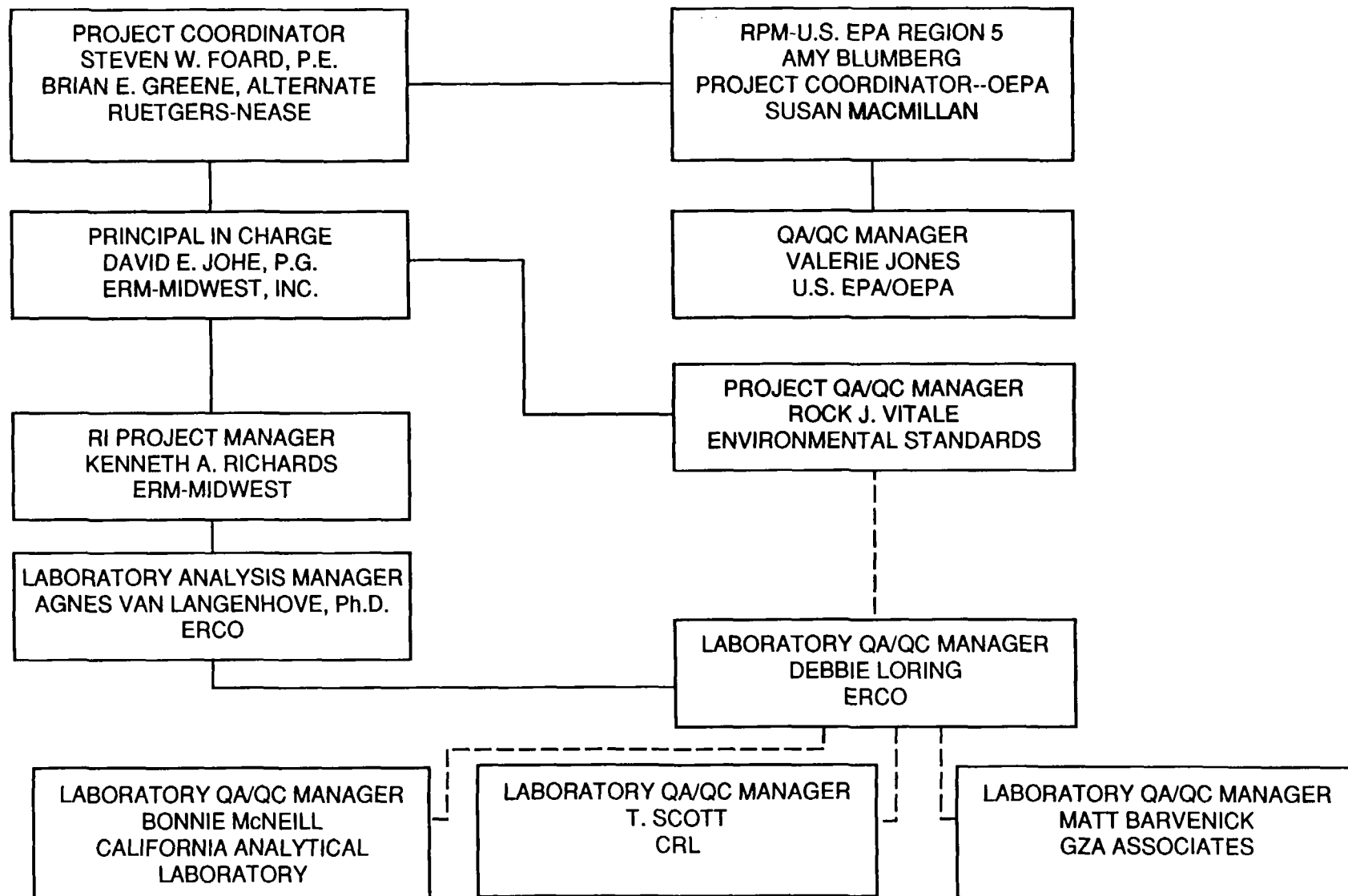
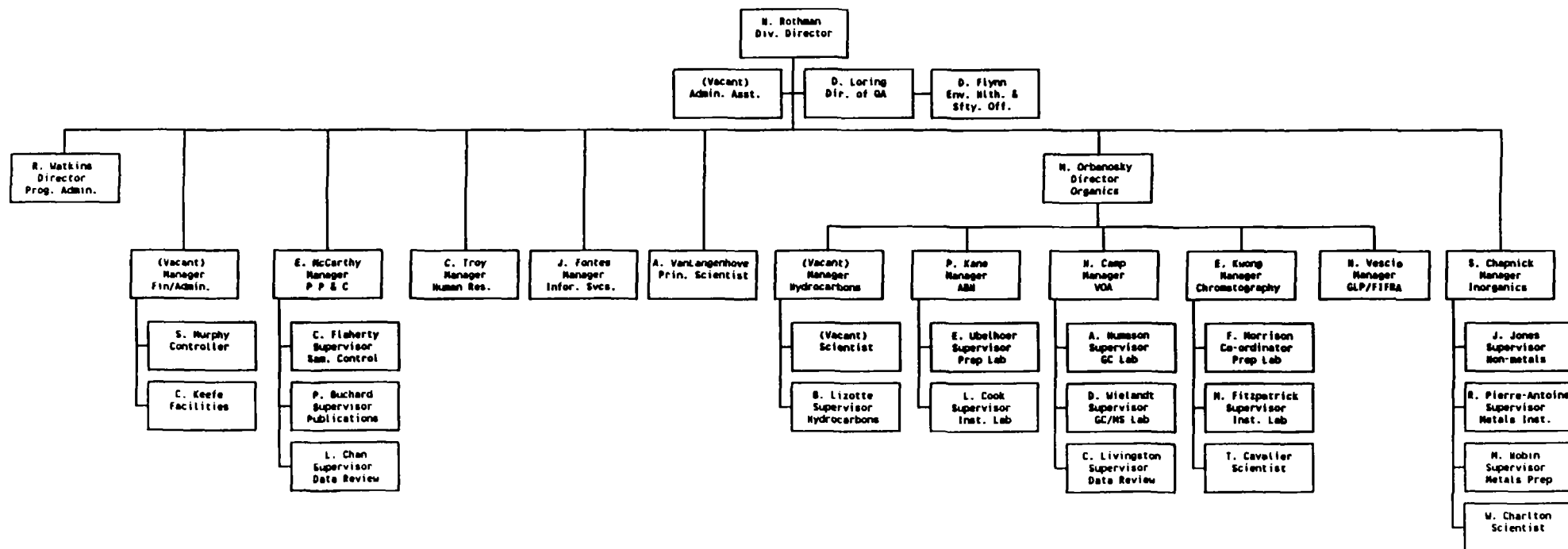


FIGURE 4-2
ERCO LABORATORY STRUCTURE



QAPP-35

Enseco-Erco Laboratory
Cambridge, Massachusetts

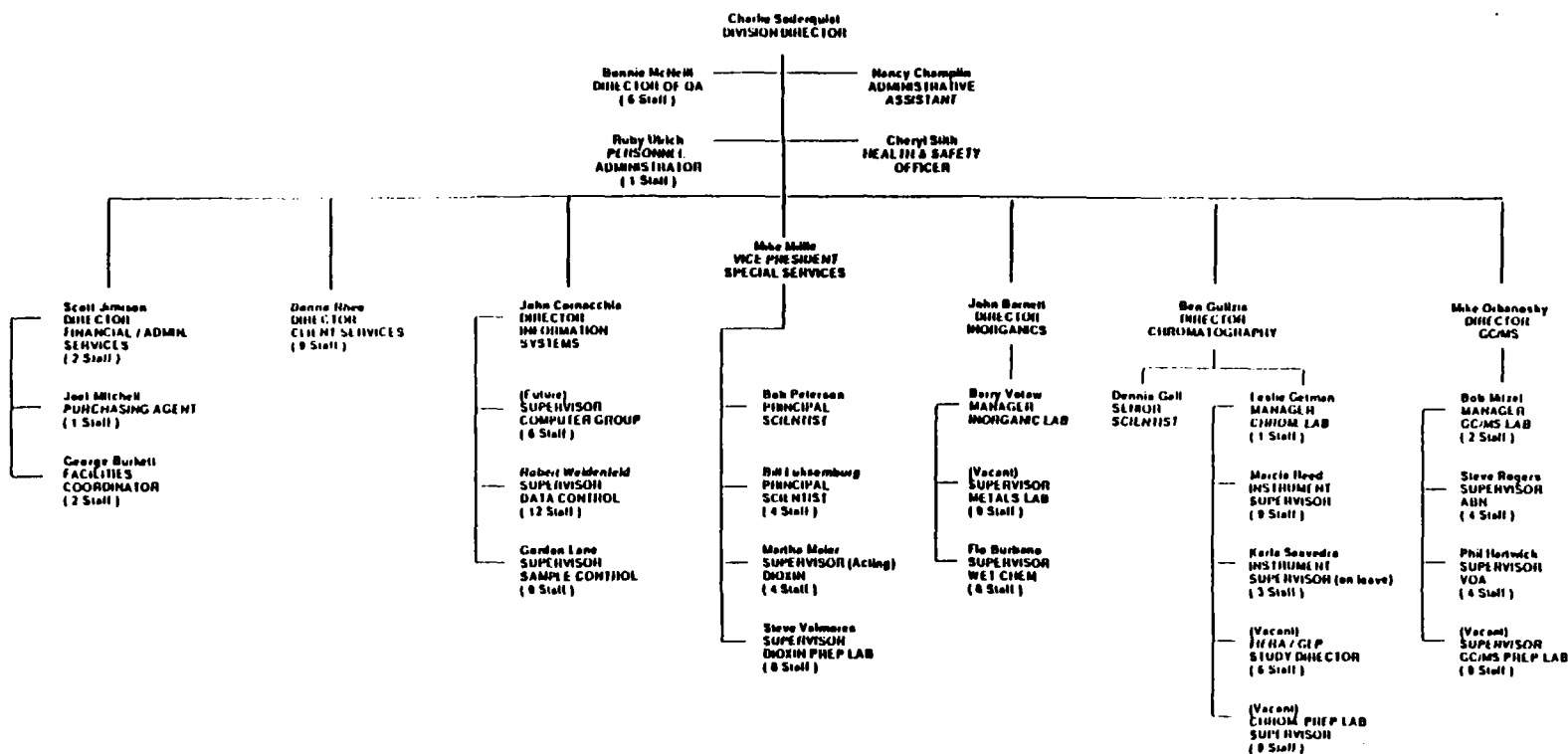
VERSION 89-2

VOLUME 2: QAPP
SECTION: 4
Rev. 4/Feb. 1990

Enseco

FIGURE QAPP 4-3

CAL ANALYTICAL LABORATORY STRUCTURE



ENSECO-CAL LAB
Organizational Chart
July 88 / Version 37

the structure of the Enseco-CAL Analytical Laboratory, where the dioxin and furans analysis will be performed. Figure 4-4 identifies the structure of the Enseco-CRL/El Monte Laboratory, where the T01 and T02 thermal desorption VOA analyses will be done.

4.2 Overall Management and QA/QC Responsibilities

General responsibilities of the individuals responsible for QA/QC are described in the following sections.

4.2.1 Project Coordinator

Steven Foard, P.E. of Ruetgers-Nease is the Project Coordinator (PC) for this investigation. The alternate PC is Brian Greene, also of Ruetgers-Nease. Responsibilities of the PC include:

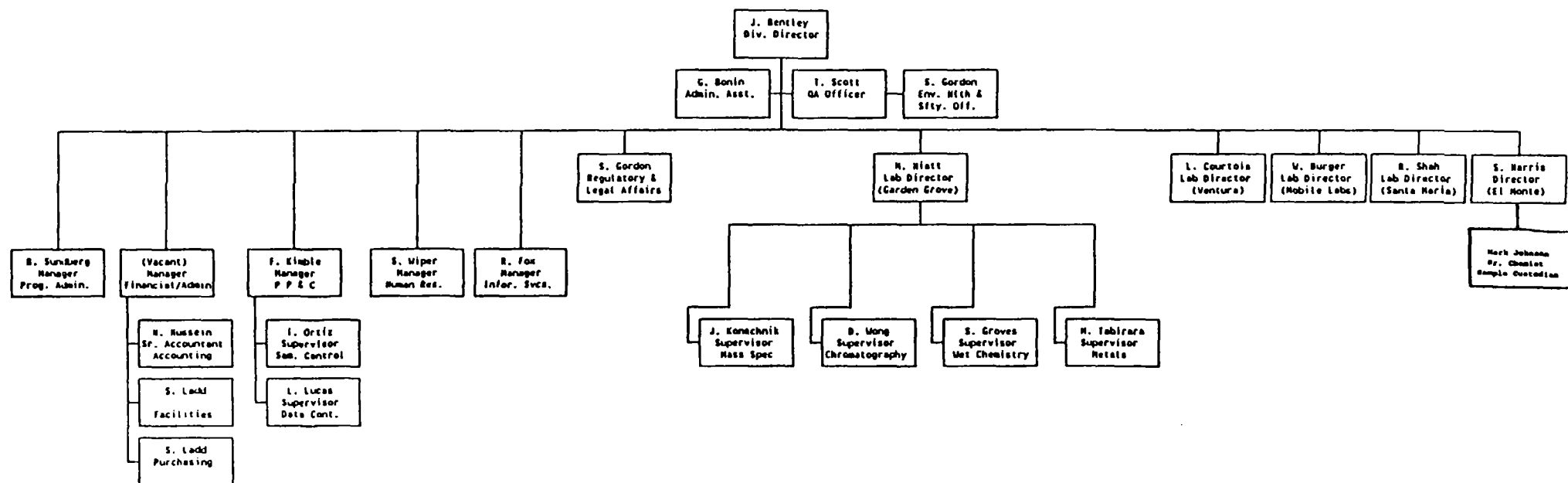
1. Interface with U.S. EPA/OEPA RPM/Project Coordinator on all aspects of the RI/FS.
2. Oversight and approval of Project plans.
3. Ensure that terms of the Consent Order and Statement of Work are met.

4.2.2 Principal-in-Charge

David E. Johe is the Principal-in-Charge for this investigation. Mr. Johe is a Principal with ERM-Midwest and is responsible for the following:

1. Resource availability to the project.
2. Overall technical direction of the project.

FIGURE 4-4
ENSECO-CRL LABORATORY STRUCTURE



Enseco-CRL

Garden Grove, Santa Maria, Ventura and El Monte, California

VOLUME 2 : QAPP
SECTION : 4
REV.4/Feb.1990

3. Review all technical documents for accuracy and completeness with respect to the QAPP and associated site plans.

4.2.3 Project QA/QC Manager

Rock J. Vitale, of Environmental Standards, Inc. is the Project Quality Assurance Manager for this investigation. He will be responsible for assuring that field, office, and laboratory activities and analyses are conducted in accordance with the QAPP. Specific responsibilities include the following:

1. Conduct performance and system audits.
2. Review all documents with respect to adherence to QA procedures provided in the QAPP.
3. Review SAS data and RAS data including mass spectral library searches for tentative identifications.
4. Preparation of analytical data tables and quality assurance reviews.
5. Recommend and institute corrective actions based on reviews and audits.

4.2.4 RI Project Manager

Kenneth A. Richards, of ERM-Midwest is the RI Project Manager for this investigation. He has overall project responsibility and direct responsibility for the management of staff involved in this project. Specific duties are as follows:

1. Providing an interface between the Project Coordinator and the Field Operations Manager.
2. Implementing project plans.
3. Coordinating project activities.
4. Coordinating project personnel and staffing.
5. Completing project deliverable reviews.
6. Providing input on technical direction.

4.2.5 Field Operations Manager

Robert A. Ferree, of ERM-Midwest is the Field Operations Manager for this project and will be responsible for on-site activities including well drilling, sampling, and health and safety. Specific activities include the following:

1. Ensure that field activities are conducted in accordance with the Site Specific Sampling Plan, QAPP, and Health and Safety Plan.
2. Review and evaluate field records.
3. Subcontractor coordination.
4. Oversight of field staff.

4.2.6 Analytical Laboratory QA Manager

The Analytical Laboratory QA Managers, Deborah Loring of ERCO, Bonnie McNeill of CAL Analytical, T. Scott of CRL and Matt Barvenick of GZA, will be responsible for the inspection and verification of laboratory QA/QC records and results. Any deviation or discrepancies in the data will be reported

to the Laboratory Manager or her assistant for review and, if necessary, appropriate corrective action. Additional responsibilities of the Analytical Laboratory QA Manager include:

1. Implementation of all laboratory QA/QC procedures contained in the QAPP.
2. Overseeing corrective actions as required.
3. Conducting internal system and performance audits and inspection of analytical procedures and implementing modifications as approved by the Project QA/QC Manager.
4. Developing laboratory QA programs including statistical procedures and techniques.
5. Review SAS and RAS data including mass spectral library searches for tentative identifications.

A final data package including all raw data will be submitted to the Project QA/QC Manager for a rigorous quality assurance review.

4.2.7 Laboratory Sample Custodian

Kathy Flaherty of ERCO, Gordon Lane of CAL Analytical, Ike Orvitz of CRL/El Monte and Janice Gregory of GZA are the designated sample custodians for this RI/FS. The sample custodian's responsibilities include ensuring proper sample entry, handling procedures and documentation by laboratory personnel.

4.2.8 U.S. EPA Remedial Project Manager and OEPA Project Coordinator

Amy Blumberg is the U.S. EPA Region 5 Remedial Project Manager and Susan MacMillan is the OEPA Project Coordinator for this RI/FS. Their responsibilities include:

1. Technical review and approval of all plans and data, including raw data, submitted as part of this RI/FS.
2. Coordination of RI/FS activities with the Project Coordinator.
3. Authority vested in an On-Scene Coordinator and a Remedial Project Manager by the National Contingency Plan, 40 CFR Part 300, as amended, including the authority as provided therein to halt conduct, or direct any work described in the RI/FS Work Plans, or to direct any response action undertaken by the U.S. EPA when conditions at the facility may present an imminent and substantial endangerment to the public health and welfare or the environment. The U.S. EPA Project Coordinator's actions shall, at all times be controlled and limited by provisions of the National Contingency Plan, 40 CFR Part 300.

4.2.9 U.S. EPA/OEPA QA Manager

Valerie Jones is the U.S. EPA QA Manager for this investigation. She is responsible for assuring that all laboratory activities and analytical data are of sufficient quality to meet the objectives of the investigation. Specific responsibilities include:

1. Technical review and approval of the QAPP submitted as part of this RI/FS
2. Coordinate with EPA Region V CRL on system and performance audits.

4.2.10 U.S. EPA Region V Central Regional Laboratory

It is the responsibility of the U.S. EPA Region V Central Regional Laboratory to perform the external performance and system audits for the laboratories selected for this project.

5.0 QA OBJECTIVES FOR MEASUREMENT DATA

The primary objective of the Quality Assurance (QA) program is to provide data of sufficient quality and quantity to assure that project objectives, as stated in Section 3.0 are achieved. Data quality and quantity are measured through comparison of resulting data with established acceptable limits for data precision, sensitivity, accuracy, representativeness, comparability and completeness (PSARCC) as described in U.S. EPA document EPA/540/G-87/003 titled, "Data Quality Objectives for Remedial Response Activities." Data that have certain aspects that may be outside PSARCC QA objectives will be evaluated, according to Section 3.2.3 of the DQO document, and the criteria contained in the current CLP-Statement of Work, to determine what, if any, aspects of the data can be defensibly used to meet the RI/FS objectives. Objectives for the PSARCC parameters for this RI/FS are described in this section.

5.1 PSARCC Objectives

PSARCC parameter objectives have been developed for four (4) sample categories based on sample objectives, analytical methods, historical data and published guidelines for the CLP. These sample categories are:

1. Samples scheduled for Standard TCL organic and inorganic analyses with routine analytical services (RAS) detection limits.
2. Samples scheduled for Standard TCL organic analyses with special analytical service (SAS) low detection limits.

3. Samples scheduled for Standard TCL organic and inorganic analyses with RAS detection levels but where matrix interferences due to expected high concentrations of compounds may prevent the achievement of RAS detection limits for other applicable constituents.
4. Samples scheduled for non-standard compound analysis such as mirex, kepone, photomirex, DPS, and DCNB.

Data quality objectives for the RI/FS are summarized in Table 5-1. The parameters for standard TCL-RAS and TCL-SAS analyses are based on CLP requirements and U.S. EPA guidance documents. PSARCC parameter objectives should be achieved through the use of standardized sample collection and analysis procedures.

Technically, obtaining RAS detection levels may not be feasible for samples with high matrix interference caused by high concentration analytes. For example, if a sufficiently high concentration of one compound is present in a sample, attempts to analyze the sample without a dilution may "shut-down" an instrument. Samples where this may occur include on-site soil and waste samples, and monitoring wells within the plume. All attempts will be made to analyze samples directly or with the absolute minimum dilution, or to perform all available clean-up techniques. However, the primary consideration for these high-level samples is the accurate identification and quantification of analytes since these high-level analytes will essentially drive the clean-up process. In addition, it should be noted that low-level detection limits can be obtained on these samples to determine if other contaminants are present after some remedial action has effectively removed or reduced the high-level components. Accordingly, project objectives could be

achieved even if RAS detection levels may not be met for high concentration samples.

Tables 5-1 through 5-3 contain separate PSARCC objectives for investigation samples. It should be noted that the criteria objectives not yet specified for Mirex, photomirex, kepone, DPS and DCNB on Table 5-2 will be specified once the method validation study is completed.

Analytical methods for non-standard compounds will be validated as part of the overall Work Plan approval. The mirex, photomirex, kepone, DPS, and DCNB method validation study will be approved by the agencies and incorporated into the Work Plan.

PSARCC parameter objectives and use are described in more detail below.

5.1.1 Precision

Precision measures the reproducibility of data or measurements under specific conditions. Precision is a quantitative measure of the variability of a group of data compared to their average value. Precision is usually stated in terms of relative percent difference or relative standard deviation. Measurement of precision is dependent upon sampling technique and analytical method. Both sampling and analysis will be as consistent as possible.

To ensure that precision is achieved, QC samples including field and laboratory duplicate samples, and matrix spike and matrix spike duplicate recoveries will be analyzed and used to measure precision. An additional measure of precision is the comparison of surrogate recoveries between the unspiked, matrix spike and matrix spike duplicate sample aliquots. As per Contract Laboratory Program (CLP)

QAPP TABLE 5-1 **Data Quality Objectives**

DQO Parameter	RAS	SAS ¹	Non-Standard Analysis ²
Precision	Tables 5-2 and 5-3	Tables 5-2 and 5-3	Tables 5-2 and 5-3
Accuracy	Tables 5-2 and 5-3	Tables 5-2 and 5-3	Tables 5-2 and 5-3
Sensitivity	Section 9 of the QAPP	Section 9 of the QAPP	Section 9 of the QAPP
Representativeness (field replicates)	Inorganic—Aq<20%RPD@>CRDL ³ Inorganic—Sol<35%RPD@>CRDL ³ Organic—VOA<15%RPD(Aq), <25%RPD(sol) ⁴ Organic—BN<25%RPD(Aq)<32% RPD(sol) ^{4,5} Organic—Acids<45%RPD(Aq)<43%RPD(sol) ⁴ Organic—Pest/PCBs<25RPD(Aq)<45%RPD(sol) ⁴ Organic—Dioxin/furans<25RPD(Aq)<45%RPD(sol) ⁴	Organics—VOA<25%RPD(air)<35%RPD (fish) Organics—BN<32%RPD(air)<40%RPD(fish) Organics—Acids<43%RPD(air)<53%RPD(fish) Organics—Pest/PCBs<45%RPD(air)<55%RPD(fish)	Mirex<25RPD(Aq)<45%RPD(sol), <45%RPD(air), <55%RPD (fish) Photomirex<25RPD(Aq)<45%RPD (sol)<45%RPD(air)<55RPD(fish) Kepone<40RPD(Aq)<50%RPD(sol), <50%RPD(air) <60%RPD(fish) Diphenyl sulfone<25%RPD(Aq), <40%RPD(sol), <40%RPD(air)<50%RPD(fish)
Completeness			
Non-Critical Samples	90%	90%	90%
Critical Samples	100% ⁶	100% ⁶	100%
Comparability	Based on precision & accuracy & media comparison	Based on precision & accuracy & media comparison	Based on precision & accuracy & media comparison

Notes:

¹SAS for fish and air matrices

²Non-Standard Analysis—mirex, photomirex, kepone, diphenyl sulfone, and 3,4-dichloronitrobenzene

³Criteria for field replicates derived from CLP Criteria

⁴Criteria for field replicates derived by calculating the mean RPD for each fraction from CLP matrix spike duplicate RPDs

⁵3,4-dichloronitrobenzene and diphenyl sulfone will be analyzed as an additional compound under CLP BN RAS

⁶Data with <100% completeness will be acceptable as long as the deficiency does not hinder project objectives; for example, compounds that are not pertinent to the investigations or common laboratory contaminants and low RFs for ketones

QAPP Table 5-2
Accuracy & Precision Data Quality Objectives for RAS & SAS Organics

Parameter	Audit	Compounds	Fish Control Limits	Aqueous Ctrl Lmts	Air Control Limits	Solid Control Limits
VOA Components	Lab blank, field blank	All TCL Compounds	<5x CRDL methylene chloride, acetone, toluene and 2-butanone ≤ CRDL all other compounds	<5 x CRDL methylene chloride, acetone, toluene and 2-butanone ≤ CRDL all other compounds	<5 x DL methylene chloride and toluene	<5 x CRDL methylene chloride, acetone, toluene and 2-butanone ≤ CRDL all other compounds
	Matrix spike duplicate precision	See Matrix spikes	<50% RPD (95% CI)	<14% RPD (95% CI)	NA	<24% RPD (95% CI)
	Surrogate Spike Recovery	D ₄ -1,2-dichloroethane D ₈ -toluene Bromofluorobenzene	(50-150%) (50-150%) (50-150%)	(76-114%) (88-110%) (86-115%)	NA NA NA	(70-121%) (81-117%) (74-121%)
	Matrix Spike Recovery	1,1-dichloroethene trichloroethene benzene toluene chlorobenzene	(49-172%) (50-150%) (50-150%) (49-150%) (50-150%)	(61-145%) (71-120%) (76-127%) (76-125%) (75-130%)	NA NA NA NA NA	(59-172%) (62-137%) (66-142%) (59-139%) (60-133%)
BNA Components, including DCNB, DPS	Lab blank, field blank	All Parameters	<5 x CRDL phthalate esters ≤ CRDL all other compounds	<5 x CRDL phthalate esters ≤ CRDL all other compounds	<5 x CRDL phthalate esters ≤ CRDL all other compounds	<5 x CRDL phthalate esters ≤ CRDL all other compounds
	Matrix spike recovery and matrix spike duplicate precision	phenol 2-chlorophenol 1,4-dichlorobenzene N-nitroso-di-n-propylamine 1,2,4-trichlorobenzene p-chloro-m-cresol acenaphthene 4-nitrophenol 2,4-dinitrotoluene pentachlorophenol pyrene 3,4-dichloronitrobenzene diphenylsulfone	(9-90%) (50% RPD) (17-123%) (50% RPD) (18-114%) (35% RPD) (21-126%) (41% RPD) (27-107%) (32% RPD) (18-102%) (47% RPD) (21-142%) (34% RPD) (6-114%) (80% RPD) (18-99%) (51% RPD) (4-110%) (60% RPD) (22-142%) (41% RPD) (36-78%) (30% RPD) (0-92%) (54% RPD)	(12-89%) (42% RPD) (27-123%) (40% RPD) (36-97%) (28% RPD) (41-118%) (38% RPD) (39-98%) (28% RPD) (23-97%) (42% RPD) (46-118%) (31% RPD) (10-80%) (50% RPD) (24-98%) (38% RPD) (9-103%) (50% RPD) (26-127%) (31% RPD) (54-94%) (30% RPD) (78-118%) (30% RPD)	(12-100%) (42% RPD) (25-123%) (50% RPD) (28-104%) (27% RPD) (41-126%) (38% RPD) (38-107%) (23% RPD) (23-103%) (42% RPD) (31-137%) (31% RPD) (10-114%) (50% RPD) (24-98%) (47% RPD) (9-109%) (50% RPD) (26-142%) (36% RPD) (75-115%) (30% RPD) (78-118%) (30% RPD)	(26-90%) (35% RPD) (25-102%) (50% RPD) (28-104%) (27% RPD) (41-126%) (38% RPD) (38-107%) (23% RPD) (26-103%) (33% RPD) (31-137%) (19% RPD) (11-114%) (50% RPD) (28-89%) (47% RPD) (17-109%) (47% RPD) (35-142%) (36% RPD) (33-76%) (30% RPD) (52-126%) (37% RPD)
	Surrogate spike recovery	d ₅ -nitrobenzene 2-fluorobiphenyl d ₁₄ -terphenyl d ₆ -phenol 2-fluorophenol 2,4,6-tribromophenol	(13-120%) (20-116%) (8-141%) (6-113%) (11-121%) (6-123%)	(35-114%) (43-118%) (33-141%) (10-94%) (21-100%) (10-123%)	(23-120%) (30-116%) (18-141%) (10-113%) (21-121%) (10-123%)	(23-120%) (30-115%) (18-137%) (24-113%) (25-121%) (19-122%)
RAS Pesticides/PCBs	Lab blank, field blank	All TCL Pesticides/PCBs	<CRDL for all compounds	<CRDL for all compounds	<CRDL for all compounds	<CRDL for all compounds
	Matrix spike recovery and matrix spike duplicate precision	lindane heptachlor aldrin dieldrin endrin 4,4-DDT	(36-123%) (50% RPD) (25-130%) (31% RPD) (24-132%) (43% RPD) (21-134%) (38% RPD) (32-139%) (45% RPD) (13-134%) (50% RPD)	(56-123%) (15% RPD) (40-131%) (20% RPD) (40-120%) (22% RPD) (52-126%) (18% RPD) (56-121%) (21% RPD) (38-127%) (27% RPD)	(46-127%) (50% RPD) (35-130%) (31% RPD) (34-132%) (43% RPD) (31-134%) (38% RPD) (42-139%) (45% RPD) (23-134%) (50% RPD)	(46-127%) (50% RPD) (35-130%) (31% RPD) (34-132%) (43% RPD) (31-134%) (38% RPD) (42-139%) (45% RPD) (23-134%) (50% RPD)
	Surrogate spike recovery	dibutylchloroendate	(10-150%)	(24-154%)	(20-150%)	(20-150%)
Mirex, Photomirex, Kepone	Lab blank, field blank	All Parameters	<MDL	<MDL	<MDL	<MDL
	Matrix spike and duplicate precision	mirex photomirex kepone	(82-122%) (30% RPD) (65-105%) (30% RPD) (24-97%) (37% RPD)	(74-114%) (30% RPD) (70-110%) (30% RPD) (19-83%) (32% RPD)	(74-117%) (30% RPD) (74-114%) (30% RPD) (0-79%) (42% RPD)	(57-124%) (34% RPD) (53-122%) (35% RPD) (25-65%) (30% RPD)
Dioxins and Furans	Lab blank, field blank	All Parameters	N/A	<MDL	N/A	<MDL
	Performance check solution (supplied by USEPA)	2,3,7,8-TCDD	N/A	within 95% CI	N/A	within 95% CI
	Fortified field blank	2,3,7,8-TCDD	N/A	60-140%	N/A	60-140%
	Laboratory duplicate	2,3,7,8-TCDD	N/A	<50% RPD	N/A	<50% RPD
	Surrogate recovery	37Cl ₄ -2,3,7,8-TCDD	N/A	±40%	N/A	±40%

NA - This medium is not scheduled for this analysis.

REV. 4/Feb. 1990

QAPP-48

QAPP Table 5-3
Accuracy and Precision Data Quality Objectives for RAS Inorganics

Parameter	Audit	Constituent	Aqueous Control Limits	Soil Control Limits
Metals and Cyanide	Lab blank, field blank	All TCL constituents	$\leq \pm \text{CRDL}$	$\leq \pm \text{CRDL}$
	Laboratory duplicates	All TCL constituents	<20% RPD for results >5 x CRDL $\leq \pm \text{CRDL}$ for results <5 x CRDL	<20% RPD for results >5 x CRDL $\leq \pm \text{CRDL}$ for results <5 x CRDL
	Matrix spike recovery	All TCL constituents	75–125% unless the sample concentration exceeds the spike added concentration by a factor of 4 or more	75–125% unless the sample concentration exceeds the spike added concentration by a factor of 4 or more

Source of Criteria is EPA's SOW887 (Multimedia Inorganic Analysis)

protocols, a one-in-twenty frequency per matrix will receive a laboratory duplicate analysis (inorganics) and matrix spike/matrix spike duplicate analysis (organics). Field blanks will be collected at a frequency of one per 10 surface water samples per day, one per 20 groundwater samples and one per 20 soil/sediment samples. The one per 20 samples for field blanks for groundwater samples apply because dedicated sampling equipment will be utilized for the collection of samples from each monitoring well. Field duplicates will be collected once for every ten samples per matrix. Field duplicate results will be evaluated during ERM's data validation.

5.1.2 Sensitivity

Detection limits for analysis scheduled to be completed for this RI/FS are specified in Section 9.0 of this QAPP. Detection limits may be affected by matrix interferences, such as those caused by highly contaminated samples. In the case where low-level detection limits are not possible, sample/extract clean-ups or an alternate analytical method will be considered. If the limits are still not achievable, the applicability of the data, with respect to meeting the RI/FS objectives, will be evaluated. It should be noted that the compounds found at high levels in such contaminated samples will, in fact, be used to develop an EA, drive the clean-up process and accordingly, satisfy the project objectives.

5.1.3 Accuracy

Accuracy measures the bias in a measurement system which may result from sampling or analytical error. Sources of error that may contribute to poor accuracy are: laboratory error, sampling inconsistency, field and/or laboratory contamination, handling, matrix interference, and

preservation. Field and trip blanks, surrogate spikes, PE samples (dioxins and furans), as well as matrix spike QC samples will be used to measure accuracy for project samples.

5.1.4 Representativeness

Representativeness expresses the degree to which sample data represents the characteristics of the media or matrix from which it is collected. Samples that are considered representative are ones that are properly collected to accurately characterize the nature and extent of contamination at a general sample location. Therefore, an adequate number of sampling locations have been chosen and the sampling methods will be consistent. Representativeness will be measured by using the methods (e.g. sampling, handling, and preserving) specified in the Site Specific Sampling Plan which was prepared in accordance with the Statement of Work and state and federal guidelines for sampling of various media. Representativeness will also be measured by the collection of field replicates (VOAs). Comparison of the analytical results from field replicates will provide a direct measure of individual sample representativeness. Field replicates for volatile organics will be collected once for every ten samples per soil matrix. Duplicates will be collected for the balance of analytical parameters at the same frequency as above.

5.1.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which data can be compared to one another. Comparability relies mainly upon precision and accuracy to be within appropriate QC limits before the data can be used for comparison of data sets. This will be accomplished through the consistent use of the analytical and sampling methods described in this document and the SSSP.

5.1.6 Completeness

Completeness is defined as the percentage of data that is judged to be valid to achieve the objectives of the RI compared to the total amount of data. Deficiencies in the data may be due to sampling techniques, or poor accuracy, precision, and laboratory error. While their deficiencies may effect certain aspects of the data, usable data may still be extracted from applicable samples. Completeness is of the utmost concern in relation to critical samples. Completeness goals with respect to the number of sample locations were developed during the Statement of Work process.

5.2 QA Objectives for Critical Samples

Critical samples are those data sets that must be valid in order to achieve project objectives. Their precision, sensitivity, accuracy, representativeness, completeness and comparability (PSARCC) are important, since they will be used to characterize specific media of concern (e.g., residential well water and background stations). Additional activity and more stringent QA objectives are listed in Table 5-4, in order to achieve PSARCC objectives.

Detection limits are also a concern for critical samples since several potential ARARs (applicable or relevant and appropriate requirements) and action levels for various matrices may be at or below standard detection limits. For the first round of samples, SAS low detection levels will be attempted for TCL analyses for residential wells and background ground water and surface water samples. Standard and non-standard detection levels are provided in Section 9.0 of this QAPP. Should first round results indicate the need to achieve lower detection levels, experience gained during first round analysis will be used to achieve lower detection

QAPP TABLE 5-4

**CRITICAL SAMPLE SUMMARY
RUTGERS-NEASE SALEM SITE RI/FS**

<u>Sample Location</u>	<u>Matrix</u>	<u>Rationale</u>	<u>Activity</u>
Well Cluster "1"	Ground Water	1) Determine existing background water quality at the site. 2) Provide basis for remediation levels.	1) Collect collocated sample from one well. 2) Complete two sample events. 3) 100X ⁽¹⁾ completeness goal. 4) SAS low detection levels. (See Section 9)
Residential Wells	Ground Water	1) Ensure acceptable drinking water quality.	1) Collect two collocated samples during each sampling event. 2) 100X ⁽¹⁾ completeness goal. 3) SAS low detection levels. (See Section 9)
MFLBC 1	Surface Water	1) Define background water quality conditions in MFLBC.	1) Collect one collocated sample at the upgradient location. 2) 100X ⁽¹⁾ completeness goal 3) SAS low detection levels. (See Section 9)
Off-Site Soil (background)	Soil	1) Define natural or background soil conditions. 2) Provide remedial design Data	1) One collocated sample from one boring. 2) 100X ⁽¹⁾ completeness goal.
MFLBC 1	Fish	1) Define background conditions	1) 100X ⁽¹⁾ completeness goal.
Slanker Pond	Surface Water	1) Ensure acceptable water quality	1) 100X ⁽¹⁾ completeness goal.

(1) Data with <100% completeness will be acceptable as long as the deficiency does not hinder project objectives.

limits, if possible. For non-standard compounds (i.e., mirex, kepone, photomirex), a study has been performed in order to facilitate the use of risk-based detection limits or the best detection limits achievable. The detection limits achieved during the MVS will be approved by the agencies prior to any work plan implementation.

5.3 Procedures for Monitoring PSARCC Parameters

PSARCC parameters will be monitored through the use of procedures which have been referred to in Section 5.1 and 5.2. These will include appropriate field blanks, trip blanks, laboratory method blanks, field and laboratory duplicates or replicates, matrix spikes, duplicate matrix spikes, surrogate spikes, performance evaluations (dioxins and furans), laboratory control samples, and a careful examination of all calibration and check standards. Laboratory control samples (LCS) and performance evaluation samples are samples containing a known or true value which the laboratory prepares and analyzes concurrently with project samples. They are of most use in judging analytical accuracy.

5.4 Field Measurements

Measurement data will be generated in many field activities that are incidental to collecting samples for analytical testing or unrelated to sampling. These activities include, but are not limited to, the following:

- o Documenting time and weather conditions
- o Locating and determining the elevation of sampling stations

- o Performing geophysical surveys
- o Determining pH, specific conductance and temperature of water samples
- o Qualitative and semi-quantitative organic vapor screening of subsurface soil samples using an FID and/or PIDs
- o Determining depths in a borehole or well
- o Standard penetration testing
- o Calculating pumping rates
- o Verifying well development and pre-sampling purge volumes
- o Performing bail-down recovery tests.

The general QA objective for field measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of the data through the documented use of standardized procedures. The procedures for performing these activities and the standardized formats for documenting them are presented in the Site Specific Sampling Plan (Appendix A). A summary of the overall project Data Quality Objectives (DQOs) and the levels of DQOs is presented as Table 5-5 and Table 5-6 respectively.

TABLE 5-5
DQO SUMMARY FORM

1. <u>Site</u> Name <u>Ruetgers-Nease</u> Location <u>Salem, Ohio</u>		EPA Region <u>V</u> Phase <u>RI 1</u> Phase <u>1</u> RI1, RI2, RI3, EA, FS, RA				VOLUME 2: QAPP SECTION 5 REV. 2-8.89					
2. <u>Media</u> (Circle one)	Soil	Ground Water	Surface Water	Sediment	<u>Air</u>	Biota	Other				
3. <u>Use</u> (Circle all that apply)	<u>Site Character-istics(H&S)</u>	<u>Risk Assess-ment</u>	<u>Evaluate Alterna-tives</u>	Engineer Design	PRP Determ.	Monitor Remedial Action	Other				
4. <u>Objective</u> <u>Determine transport mechanisms for site characterization and assessment of risk to human health and environmental receptors</u>											
5. <u>Site Information</u> Area <u>44 acres</u> Depth to Ground Water <u>0-31 ft.</u> Ground Water Use <u>Private potable wells within 1 mile, - also non-potable uses</u> Soil Types <u>Glacial till over limestone and shale bedrock</u> Sensitivity Receptors <u>Residents, Biota</u>											
6. <u>Data Types</u>											
A. <u>Analytical Data</u>				B. <u>Physical Data</u>							
pH Conductivity <u>VOA w/o ketones</u> <u>ABN</u> TCLP				<u>Pesticides</u> <u>PCBs</u> Metals Cyanide <u>Particulates</u> <u>Mirex</u> <u>Photomirex</u> <u>Kepon</u> <u>DPS</u>				Permeability Porosity Grain Size Atterburg Limits Moisture Soil Classification Specific Gravity			
7. <u>Sampling Method</u> (Circle Methods to be used)											
<u>Environmental</u> Source		<u>Biased</u> Grid		<u>Grab</u> Composite		<u>Non-Intrusive</u> <u>Intrusive</u>					
8. <u>Analytical Levels</u> (Indicate Level(s) and Equipment & Methods)											
Level 1 Field Screening - Equipment <u>OVA, HNU, explosimeter</u>											
Level 2 Field Analysis - Equipment											
Level 3 Non-CLP Laboratory Methods											
Level 4 CLP/RAS - Methods											
Level 5 Non-Standard <u>DPS, BNA, Pest/PCB, VOA (w/o ketones), Mirex, Photomirex, Kepon</u>											
9. <u>Sampling Procedures</u>											
Background <u>1 Upwind</u>											
Critical (List) <u>On-site and downwind</u>											
Procedures <u>Low-Vol pumps w/tenax, CMS, PUF cartridges, High-Vol for particulates</u>											
10. <u>Quality Control Samples</u> (Confirm or Set Standard)											
A. <u>Field</u>				B. <u>Laboratory</u>							
Collocated-5% or <u>none</u>				Reagent Blank-1 per analytical batch or							
Replicate-5% or <u>10%</u>				Replicate - 1 per analytical batch or							
Field Blank-5% or <u>5%</u>				Matrix spike-1 per analytical batch or							
Trip Blank-1 per day or <u>5%</u>				Other <u>No matrix spikes for air</u>							
CONSULTANT <u>ERM-Midwest</u>				PREPARER <u>Rock J. Vitale</u>							
PROJECT MANAGER <u>Kenneth Richards</u>				DATE <u>7/31/89</u>							

TABLE 5-5 (cont.)
DQO SUMMARY FORM

VOLUME 2: QAPP
SECTION: 5
REV.4/Feb.1990

1. Site Name <u>Ruetgers-Nease</u> Location <u>Salem, Ohio</u>		EPA Region <u>V</u> Phase <u>RI 1</u> Phase <u>1</u> RI1, RI2, RI3, EA, FS, RA				VOLUME 2: QAPP SECTION 5 REV. 2-8.89							
2. Media (Circle one)	Soil	Ground Water	Surface Water	Sediment	Air	Biota	Other						
3. Use (Circle all that apply)	Site Character- istics(H&S)	Risk Assess- ment	Evaluate Alterna- tives	Engineer Design	PRP Determ.	Monitor Remedial Action	Other						
4. Objective <u>Assess Quality of surface water, risk to human health and biota by ingestion or contact, levels of contamination</u>													
5. Site Information Area <u>44 acres</u> Depth to Ground Water <u>0-31 ft.</u> Ground Water Use <u>Private potable wells within 1 mile, - also non-potable uses</u> Soil Types <u>Glacial till over limestone and shale bedrock</u> Sensitivity Receptors <u>Residents, Biota</u>													
6. Data Types <table style="width:100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> A. Analytical Data pH Conductivity VOA ABN TCLP </td> <td style="width: 50%; vertical-align: top;"> B. Physical Data Permeability Porosity Grain Size Atterburg Limits </td> </tr> <tr> <td style="vertical-align: top;"> Pesticides PCBs Metals Cyanide Mirex </td> <td style="vertical-align: top;"> Photomirex Kepone DPS Methoxychlor Flow 4 <input checked="" type="checkbox"/> </td> </tr> <tr> <td></td> <td style="vertical-align: top;"> Moisture Soil Classification Specific Gravity </td> </tr> </table>								A. Analytical Data pH Conductivity VOA ABN TCLP	B. Physical Data Permeability Porosity Grain Size Atterburg Limits	Pesticides PCBs Metals Cyanide Mirex	Photomirex Kepone DPS Methoxychlor Flow 4 <input checked="" type="checkbox"/>		Moisture Soil Classification Specific Gravity
A. Analytical Data pH Conductivity VOA ABN TCLP	B. Physical Data Permeability Porosity Grain Size Atterburg Limits												
Pesticides PCBs Metals Cyanide Mirex	Photomirex Kepone DPS Methoxychlor Flow 4 <input checked="" type="checkbox"/>												
	Moisture Soil Classification Specific Gravity												
7. Sampling Method (Circle Methods to be used) <div style="display: flex; justify-content: space-around;"> Environmental Source Biased Grid Grab Composite Non-Intrusive Intrusive Phased </div>													
8. Analytical Levels (Indicate Level(s) and Equipment & Methods) Level 1 Field Screening - Equipment <u>pH meter, Conduc. meter, D.O. meter, Flow, Temp.</u> Level 2 Field Analysis - Equipment _____ Level 3 Non-CLP Laboratory Methods _____ Level 4 CLP/RAS - Methods <u>VOA, BNA, Pest/PCB, DPS, Methoxychlor</u> Level 5 Non-Standard <u>Mirex, Kepone, Photomirex</u>													
9. Sampling Procedures Background <u>Upgradient</u> Critical (List) <u>All surface water samples</u> Procedures <u>Grab samples using glass beaker, Kemmerer sampler for Slanker pond</u>													
10. Quality Control Samples (Confirm or Set Standard) <table style="width:100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> A. Field Collocated-5% or <u>1 at upgrad</u> Replicate-5% or <u>10%</u> Field Blank-5% or <u>10%</u> Trip Blank-1 per day or <u>1/VOA cooler</u> </td> <td style="width: 50%; vertical-align: top;"> B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate for Mirex per sample</u> </td> </tr> </table>								A. Field Collocated-5% or <u>1 at upgrad</u> Replicate-5% or <u>10%</u> Field Blank-5% or <u>10%</u> Trip Blank-1 per day or <u>1/VOA cooler</u>	B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate for Mirex per sample</u>				
A. Field Collocated-5% or <u>1 at upgrad</u> Replicate-5% or <u>10%</u> Field Blank-5% or <u>10%</u> Trip Blank-1 per day or <u>1/VOA cooler</u>	B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate for Mirex per sample</u>												
CONSULTANT <u>ERM-Midwest</u> PROJECT MANAGER <u>Kenneth Richards</u>				PREPARER <u>Rock J. Vitale</u> DATE <u>7/31/89</u>									

TABLE 5-5 (cont.)
DQO SUMMARY FORM

VOLUME2: QAPP
SECTION: 5
REV.4/Feb.1990

1. Site Name <u>Ruetgers-Nease</u> Location <u>Salem, Ohio</u>		EPA Region <u>V</u> Phase <u>RI 1</u> Phase <u>1</u> RI1, RI2, RI3, EA, FS, RA				VOLUME 2: QAPP SECTION 5 REV. 2-8.89			
2. Media (Circle one)	Soil	Ground Water	Surface Water	Sediment	Air	Biota	Other		
3. Use (Circle all that apply)	Site Character- istics(H&S)	Risk Assess- ment	Evaluate Alternat- ives	Engineer Design	PRP Determ.	Monitor Remedial Action	Other		
4. Objective <u>Determine chemical composition to determine potential exposure to human health</u>									
5. Site Information Area <u>44 acres</u> Depth to Ground Water <u>0-31 ft.</u> Ground Water Use <u>Private potable wells within 1 mile, - also non-potable uses</u> Soil Types <u>Glacial till over sandstone and shale bedrock</u> Sensitivity Receptors <u>Biota, Recreational user - consumers</u>									
6. Data Types <table style="width:100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> A. Analytical Data pH Conductivity VOA ABN TCLP </td> <td style="width: 50%; vertical-align: top;"> B. Physical Data Permeability Porosity Grain Size Atterburg Limits </td> </tr> </table>								A. Analytical Data pH Conductivity VOA ABN TCLP	B. Physical Data Permeability Porosity Grain Size Atterburg Limits
A. Analytical Data pH Conductivity VOA ABN TCLP	B. Physical Data Permeability Porosity Grain Size Atterburg Limits								
7. Sampling Method (Circle Methods to be used) <div style="display: flex; justify-content: space-around;"> Environmental Source Biased Grid Grab Composite Non-Intrusive Intrusive Phased </div>									
8. Analytical Levels (Indicate Level(s) and Equipment & Methods) Level 1 Field Screening - Equipment _____ Level 2 Field Analysis - Equipment <u>Scale-weight, Ruler-size</u> Level 3 Non-CLP Laboratory Methods _____ Level 4 CLP/RAS - Methods <u>VOA, BNA, Pest/PCBs, Methoxychlor, 3,4-DCNB, DPS</u> Level 5 Non-Standard <u>Mirex, Kepone, Photomirex</u>									
9. Sampling Procedures Background <u>Several upstream specimens</u> Critical (List) <u>All fish samples</u> Procedures <u>Electroshock & fyke nets, sort, weight, homogenize lower-level, fillet-upper</u>									
10. Quality Control Samples (Confirm or Set Standard) <table style="width:100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> A. Field Collocated-5% or <u>none</u> Replicate-5% or <u>10%</u> Field Blank-5% or <u>none</u> Trip Blank-1 per day or <u>5%</u> </td> <td style="width: 50%; vertical-align: top;"> B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate spikes for Mirex-1/sample</u> </td> </tr> </table>								A. Field Collocated-5% or <u>none</u> Replicate-5% or <u>10%</u> Field Blank-5% or <u>none</u> Trip Blank-1 per day or <u>5%</u>	B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate spikes for Mirex-1/sample</u>
A. Field Collocated-5% or <u>none</u> Replicate-5% or <u>10%</u> Field Blank-5% or <u>none</u> Trip Blank-1 per day or <u>5%</u>	B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate spikes for Mirex-1/sample</u>								
CONSULTANT <u>ERM-Midwest</u> PROJECT MANAGER <u>Kenneth Richards</u>				PREPARER <u>Rock J. Vitale</u> DATE <u>7/31/89</u>					

TABLE 5-5 (cont.)
DQO SUMMARY FORM

1. Site Name <u>Ruetgers-Nease</u> Location <u>Salem, Ohio</u>		EPA Region <u>V</u> Phase <u>RI 1</u> Phase <u>1</u> RI1, RI2, RI3, EA, FS, RA				VOLUME 2: QAPP SECTION 5 REV. 2-8.89																																																	
2. Media (Circle one)	Soil	Ground Water	Surface Water	Sediment	Air	Biota	Other																																																
3. Use (Circle all that apply)	Site Character- istics(H&S)	Risk Assess- ment	Evaluate Alterna- tives	Engineer Design	PRP Determ.	Monitor Remedial Action	Other _____																																																
4. Objective <u>Site characterization, determine risk to receptors, evaluate or level of contaminants in the aquifers under the site, study hydraulics and aquifer characteristics</u>																																																							
5. Site Information Area <u>44 acres</u> Depth to Ground Water <u>0-31 ft.</u> Ground Water Use <u>Private potable wells within 1 mile, - also non-potable uses</u> Soil Types <u>Glacial till over sandstone and shale bedrock</u> Sensitivity Receptors <u>Residents</u>																																																							
6. Data Types <table style="width:100%; border: none;"> <tr> <td colspan="4" style="text-align: center;">A. Analytical Data</td> <td colspan="4" style="text-align: center;">B. Physical Data</td> </tr> <tr> <td style="text-align: center;">pH</td> <td style="text-align: center;">Pesticides</td> <td style="text-align: center;">Kepone</td> <td style="text-align: center;">Permeability</td> <td style="text-align: center;">Moisture</td> <td colspan="3"></td> </tr> <tr> <td style="text-align: center;">Conductivity</td> <td style="text-align: center;">PCBs</td> <td style="text-align: center;">Photomirex</td> <td style="text-align: center;">Porosity</td> <td style="text-align: center;">Soil Classification</td> <td colspan="3"></td> </tr> <tr> <td style="text-align: center;">VOA</td> <td style="text-align: center;">Metals</td> <td style="text-align: center;">DPS</td> <td style="text-align: center;">Grain Size</td> <td style="text-align: center;">Specific Gravity</td> <td colspan="3"></td> </tr> <tr> <td style="text-align: center;">ABN</td> <td style="text-align: center;">Cyanide</td> <td style="text-align: center;">3,4-DCNB</td> <td style="text-align: center;">Atterburg Limits</td> <td colspan="4"></td> </tr> <tr> <td style="text-align: center;">TCPLP</td> <td style="text-align: center;">Mirex</td> <td style="text-align: center;">Dioxins/Furans</td> <td colspan="5"></td> </tr> </table>								A. Analytical Data				B. Physical Data				pH	Pesticides	Kepone	Permeability	Moisture				Conductivity	PCBs	Photomirex	Porosity	Soil Classification				VOA	Metals	DPS	Grain Size	Specific Gravity				ABN	Cyanide	3,4-DCNB	Atterburg Limits					TCPLP	Mirex	Dioxins/Furans					
A. Analytical Data				B. Physical Data																																																			
pH	Pesticides	Kepone	Permeability	Moisture																																																			
Conductivity	PCBs	Photomirex	Porosity	Soil Classification																																																			
VOA	Metals	DPS	Grain Size	Specific Gravity																																																			
ABN	Cyanide	3,4-DCNB	Atterburg Limits																																																				
TCPLP	Mirex	Dioxins/Furans																																																					
7. Sampling Method (Circle Methods to be used) <table style="width:100%; border: none;"> <tr> <td style="text-align: center;">Environmental Source</td> <td style="text-align: center;">Biased Grid</td> <td style="text-align: center;">Grab Composite</td> <td style="text-align: center;">Non-Intrusive Intrusive</td> <td style="text-align: center;">Phased</td> <td colspan="3"></td> </tr> </table>								Environmental Source	Biased Grid	Grab Composite	Non-Intrusive Intrusive	Phased																																											
Environmental Source	Biased Grid	Grab Composite	Non-Intrusive Intrusive	Phased																																																			
8. Analytical Levels (Indicate Level(s) and Equipment & Methods) Level 1 Field Screening - Equipment <u>pH, Cond., D.O.-meter, OVA, HNU, temp.</u> Level 2 Field Analysis - Equipment _____ Level 3 Non-CLP Laboratory Methods _____ Level 4 CLP/RAS - Methods <u>VOA, BNA, pest/PCBs, metals, diox/Fur, DPS & 3,4-DCNB</u> Level 5 Non-Standard <u>VOA, BNA, pest/PCB, VOA (w/o ketones), Mirex, Photomirex, Kepone</u>																																																							
9. Sampling Procedures Background <u>none</u> Critical (List) <u>Well Cluster "I", Residential Wells, Country Club Well</u> Procedures <u>Bailer/Bladder Pump after installation & develop., Tap-Resid. wells</u>																																																							
10. Quality Control Samples (Confirm or Set Standard) <table style="width:100%; border: none;"> <tr> <td colspan="4" style="text-align: center;">A. Field</td> <td colspan="4" style="text-align: center;">B. Laboratory</td> </tr> <tr> <td colspan="4">Collocated-5% or _____</td> <td colspan="4">Reagent Blank-1 per analytical batch or _____</td> </tr> <tr> <td colspan="4">Replicate-5% or <u>10%</u></td> <td colspan="4">Replicate - 1 per analytical batch or _____</td> </tr> <tr> <td colspan="4">Field Blank-5% or <u>5%</u></td> <td colspan="4">Matrix spike-1 per analytical batch or _____</td> </tr> <tr> <td colspan="4">Trip Blank-1 per day or <u>1/VOA cooler</u></td> <td colspan="4">Other <u>Surroqates for Mirex - 1 per sample</u></td> </tr> </table>								A. Field				B. Laboratory				Collocated-5% or _____				Reagent Blank-1 per analytical batch or _____				Replicate-5% or <u>10%</u>				Replicate - 1 per analytical batch or _____				Field Blank-5% or <u>5%</u>				Matrix spike-1 per analytical batch or _____				Trip Blank-1 per day or <u>1/VOA cooler</u>				Other <u>Surroqates for Mirex - 1 per sample</u>											
A. Field				B. Laboratory																																																			
Collocated-5% or _____				Reagent Blank-1 per analytical batch or _____																																																			
Replicate-5% or <u>10%</u>				Replicate - 1 per analytical batch or _____																																																			
Field Blank-5% or <u>5%</u>				Matrix spike-1 per analytical batch or _____																																																			
Trip Blank-1 per day or <u>1/VOA cooler</u>				Other <u>Surroqates for Mirex - 1 per sample</u>																																																			
CONSULTANT <u>ERM-Midwest</u> PROJECT MANAGER <u>Kenneth Richards</u>				PREPARER <u>Rock J. Vitale</u> DATE <u>7/31/89</u>																																																			

TABLE 5-5 (cont.)
DQO SUMMARY FORM

1. Site Name <u>Ruettgers-Nease</u> Location <u>Salem, Ohio</u>		EPA Region <u>V</u> Phase <u>RI 1</u> Phase <u>1</u> RI1, RI2, RI3, EA, FS, RA				VOLUME 2: QAPP SECTION 5 REV. 2-8.89						
2. Media (Circle one)	<input checked="" type="radio"/> Soil	<input type="radio"/> Ground Water	<input type="radio"/> Surface Water	<input type="radio"/> Sediment	<input type="radio"/> Air	<input type="radio"/> Biota	<input type="radio"/> Other					
3. Use (Circle all that apply)	<input checked="" type="radio"/> Site Character- istics (H&S)	<input checked="" type="radio"/> Risk Assess- ment	<input checked="" type="radio"/> Evaluate Alterna- tives	<input type="radio"/> Engineer Design	<input type="radio"/> PRP Determ.	<input type="radio"/> Monitor Remedial Action	<input type="radio"/> Other					
4. Objective <u>Determine transport mechanisms for site characterization and assessment of risk to human health and environmental receptors</u>												
5. Site Information Area <u>44 acres</u> Depth to Ground Water <u>0-31 ft.</u> Ground Water Use <u>Private potable wells within 1 mile, - also non-potable uses</u> Soil Types <u>Glacial till over limestone and shale bedrock</u> Sensitivity Receptors <u>Residents, Biota</u>												
6. Data Types <table style="width:100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> A. Analytical Data pH <u>PCBs</u> Conductivity <u>Metals</u> <u>VOA</u> <u>ABN</u> TCLP <u>Mirex</u> </td> <td style="width: 50%; vertical-align: top;"> B. Physical Data <u>Kepone</u> <u>Photomirex</u> <u>DPS</u> <u>3,4-DCNB</u> <u>Dioxins/Furans</u> <u>Permeability</u> <u>Porosity</u> <u>Grain Size</u> <u>Atterburg Limits</u> <u>Moisture</u> <u>Soil Classification</u> <u>Specific Gravity</u> <u>Hydraulic Conductivity</u> </td> </tr> </table>								A. Analytical Data pH <u>PCBs</u> Conductivity <u>Metals</u> <u>VOA</u> <u>ABN</u> TCLP <u>Mirex</u>	B. Physical Data <u>Kepone</u> <u>Photomirex</u> <u>DPS</u> <u>3,4-DCNB</u> <u>Dioxins/Furans</u> <u>Permeability</u> <u>Porosity</u> <u>Grain Size</u> <u>Atterburg Limits</u> <u>Moisture</u> <u>Soil Classification</u> <u>Specific Gravity</u> <u>Hydraulic Conductivity</u>			
A. Analytical Data pH <u>PCBs</u> Conductivity <u>Metals</u> <u>VOA</u> <u>ABN</u> TCLP <u>Mirex</u>	B. Physical Data <u>Kepone</u> <u>Photomirex</u> <u>DPS</u> <u>3,4-DCNB</u> <u>Dioxins/Furans</u> <u>Permeability</u> <u>Porosity</u> <u>Grain Size</u> <u>Atterburg Limits</u> <u>Moisture</u> <u>Soil Classification</u> <u>Specific Gravity</u> <u>Hydraulic Conductivity</u>											
7. Sampling Method (Circle Methods to be used) <table style="width:100%; border: none;"> <tr> <td style="width: 25%;">Environmental <u>Source</u></td> <td style="width: 25%; text-align: center;"> <input checked="" type="radio"/> Biased Grid </td> <td style="width: 25%; text-align: center;"> <input checked="" type="radio"/> Grab Composite </td> <td style="width: 25%; text-align: center;"> <input type="radio"/> Non-Intrusive Intrusive </td> <td style="width: 20%; text-align: center;"> <input type="radio"/> Phased </td> </tr> </table>								Environmental <u>Source</u>	<input checked="" type="radio"/> Biased Grid	<input checked="" type="radio"/> Grab Composite	<input type="radio"/> Non-Intrusive Intrusive	<input type="radio"/> Phased
Environmental <u>Source</u>	<input checked="" type="radio"/> Biased Grid	<input checked="" type="radio"/> Grab Composite	<input type="radio"/> Non-Intrusive Intrusive	<input type="radio"/> Phased								
8. Analytical Levels (Indicate Level(s) and Equipment & Methods) Level 1 Field Screening - Equipment <u>OVA and HNU</u> Level 2 Field Analysis - Equipment <u>Permeameter, Conductivity, Seimic, OVA (soil gas)</u> Level 3 Non-CLP Laboratory Methods <u>Physical testing</u> Level 4 CLP/RAS - Methods <u>VOA, BNA, Pest/PCBs, Dioxins/Furans, DPS, 3,4-DCNB</u> Level 5 Non-Standard <u>Mirex, Kepone, Photomirex</u>												
9. Sampling Procedures Background <u>Multiple off-site and floodplain soils</u> Critical (List) <u>off-site, on-site ponds</u> Procedures <u>Composite intervals for non-volatiles, grab highest OVA interval for VOA</u>												
10. Quality Control Samples (Confirm or Set Standard) <table style="width:100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> A. Field Collocated-5% or <u>1</u> per interval Replicate-5% or <u>10%</u> Field Blank-5% or <u>5%</u> Trip Blank-1 per day or <u>5%</u> for VOA </td> <td style="width: 50%; vertical-align: top;"> B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate Spike for Mirex</u> </td> </tr> </table>								A. Field Collocated-5% or <u>1</u> per interval Replicate-5% or <u>10%</u> Field Blank-5% or <u>5%</u> Trip Blank-1 per day or <u>5%</u> for VOA	B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate Spike for Mirex</u>			
A. Field Collocated-5% or <u>1</u> per interval Replicate-5% or <u>10%</u> Field Blank-5% or <u>5%</u> Trip Blank-1 per day or <u>5%</u> for VOA	B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate Spike for Mirex</u>											
CONSULTANT <u>ERM-Midwest</u> PROJECT MANAGER <u>Kenneth Richards</u>				PREPARER <u>Rock J. Vitale</u> DATE <u>7/31/89</u>								

TABLE 5-5 (cont.)
DQO SUMMARY FORM

1. Site Name <u>Ruetgers-Nease</u> Location <u>Salem, Ohio</u>		EPA Region <u>V</u> Phase <u>RI 1</u> Phase <u>1</u> RI1, RI2, RI3, EA, FS, RA				VOLUME 2: QAPP SECTION 5 REV. 2-8.89						
2. Media (Circle one)	Soil	Ground Water	Surface Water	Sediment	Air	Biota	Other					
3. Use (Circle all that apply)	Site Character- istics(H&S)	Risk Assess- ment	Evaluate Alterna- tives	Engineer Design	PRP Determ.	Monitor Remedial Action	Other _____					
4. Objective <u>Determine stream sediment and pond sediment composite. Determine risk to biota, recreational users and possible transport mechanisms</u>												
5. Site Information Area <u>44 acres</u> Depth to Ground Water <u>0-31 ft.</u> Ground Water Use <u>Private potable wells within 1 mile, - also non-potable uses</u> Soil Types <u>Glacial till over limestone and shale bedrock</u> Sensitivity Receptors <u>Biota, Recreational Users, Residents</u>												
6. Data Types <table style="width:100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> A. Analytical Data pH _____ Conductivity _____ VOA _____ ABN _____ TCLP _____ Pesticides _____ PCBs _____ Metals _____ Cyanide _____ DPS _____ Kepone _____ Mirex _____ Photomirex _____ </td> <td style="width: 50%; vertical-align: top;"> B. Physical Data Permeability _____ Porosity _____ Grain Size _____ Atterburg Limits _____ Moisture _____ Soil Classification _____ Specific Gravity _____ </td> </tr> </table>								A. Analytical Data pH _____ Conductivity _____ VOA _____ ABN _____ TCLP _____ Pesticides _____ PCBs _____ Metals _____ Cyanide _____ DPS _____ Kepone _____ Mirex _____ Photomirex _____	B. Physical Data Permeability _____ Porosity _____ Grain Size _____ Atterburg Limits _____ Moisture _____ Soil Classification _____ Specific Gravity _____			
A. Analytical Data pH _____ Conductivity _____ VOA _____ ABN _____ TCLP _____ Pesticides _____ PCBs _____ Metals _____ Cyanide _____ DPS _____ Kepone _____ Mirex _____ Photomirex _____	B. Physical Data Permeability _____ Porosity _____ Grain Size _____ Atterburg Limits _____ Moisture _____ Soil Classification _____ Specific Gravity _____											
7. Sampling Method (Circle Methods to be used) <table style="width:100%; border: none;"> <tr> <td style="text-align: center;">Environmental Source</td> <td style="text-align: center; border: 2px solid black;">Biased Grid</td> <td style="text-align: center; border: 2px solid black;">Grab Composite</td> <td style="text-align: center; border: 2px solid black;">Non-Intrusive Intrusive</td> <td style="text-align: center;">Phased</td> </tr> </table>								Environmental Source	Biased Grid	Grab Composite	Non-Intrusive Intrusive	Phased
Environmental Source	Biased Grid	Grab Composite	Non-Intrusive Intrusive	Phased								
8. Analytical Levels (Indicate Level(s) and Equipment & Methods) Level 1 Field Screening - Equipment _____ Level 2 Field Analysis - Equipment _____ Level 3 Non-CLP Laboratory Methods _____ Level 4 CLP/RAS - Methods <u>VOA, BNA, Pest/PCBs, DPS, Methoxychlor</u> Level 5 Non-Standard <u>Kepone, Mirex, Photomirex</u>												
9. Sampling Procedures Background <u>Upstream seds</u> Critical (List) <u>Slanker Pond, upstream & all downstream samples</u> Procedures <u>Stream 4-6" Cores, Dredge-Pond, Composite non-volatile aliquots</u>												
10. Quality Control Samples (Confirm or Set Standard) <table style="width:100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> A. Field Collocated-5% or _____ Replicate-5% or <u>10%</u> Field Blank-5% or <u>5%</u> Trip Blank-1 per day or <u>5% for VOA</u> </td> <td style="width: 50%; vertical-align: top;"> B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate spike for Mirex</u> </td> </tr> </table>								A. Field Collocated-5% or _____ Replicate-5% or <u>10%</u> Field Blank-5% or <u>5%</u> Trip Blank-1 per day or <u>5% for VOA</u>	B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate spike for Mirex</u>			
A. Field Collocated-5% or _____ Replicate-5% or <u>10%</u> Field Blank-5% or <u>5%</u> Trip Blank-1 per day or <u>5% for VOA</u>	B. Laboratory Reagent Blank-1 per analytical batch or _____ Replicate - 1 per analytical batch or _____ Matrix spike-1 per analytical batch or _____ Other <u>Surrogate spike for Mirex</u>											
CONSULTANT <u>ERM-Midwest</u> PROJECT MANAGER <u>Kenneth Richards</u>				PREPARER <u>Rock J. Vitale</u> DATE <u>7/31/89</u>								

QAPP TABLE 5-6
LEVELS OF DATA QUALITY OBJECTIVES

SAMPLE MATRIX	FIELD PARAMETERS	LABORATORY PARAMETERS	LEVEL OF DQOs
Soil	OVA HNu- (Screening) Hydraulic Conductivity, OVA- (Soil Gas)	-	I
			II
		Soil Physical Testing	III
		CLP RAS VOA +15, CLP RAS BNA +25, CLP Pesticides & PCBs, TAL Inorganics, CLP Dioxins/Furans, DPS & 3,4-DCNB	IV
		Mirex, Kepone, Photomirex	V
Sediment	-	CLP RAS VOA +15, CLP RAS BNA +25, CLP Pesticides & PCBs, DPS & 3,4-DCNB, Methoxychlor	IV
		Mirex, Kepone, Photomirex	V
Surface Water	OVA, HNu pH, Conductivity, DO & Temperature	-	I
		CLP RAS VOA +15, CLP RAS BNA +25, CLP Pesticides & PCBs, DPS, Methoxychlor	IV
		Mirex, Kepone, Photomirex	V
Groundwater	pH, Conductivity, DO & Temperature	-	I
		CLP RAS VOA +15, CLP RAS BNA +25, CLP RAS Pesticides & PCBs, TAL Inorganics, CLP Dioxins/Furans, DPS, 3,4-DCNB	IV
		TCL VOAs +15 (Low Detection Limits), TCL BNAs +25 (Low Detection Limits), Mirex, Kepone, Photomirex	V
Biota	Weight, Size		II
		CLP RAS VOA +15, CLP RAS BNA +25, TCL RAS Pesticides & PCBs, DPS, Methoxychlor	IV
		Mirex, Kepone, Photomirex	V
Air	OVA, HNu	-	I
		TCL RAS VOA+15 (minus 4 Ketones), TCL RAS BNA +25, TCL RAS Pesticides & PCBs, DPS, Particulates	IV
		Mirex, Kepone, Photomirex	V

6.0 SAMPLING PROCEDURES

6.1 Sampling Rationale

Sample locations and analyses have been specifically selected to provide data necessary to meet the objectives of the RI and to develop a comprehensive EA. Sampling locations and analytical parameters were selected in order to determine the characteristics, extent and magnitude of contamination on and off the site, sample all media to determine pathways of contaminant migration from the site, determine the contaminant flux across the site boundaries, and to ultimately establish with a high degree of confidence the boundaries where contamination attributable to this site is no longer detected. Sample type, location, general collection method and sampling objectives are listed on Table 3-4 of this QAPP.

6.2 Sampling Protocol Summary

The Site Specific Sampling Plan (SSSP), or Work Plan Volume 3, contains detailed descriptions of the objectives and rationale of the sampling program and the sampling procedures that will be followed during this RI/FS. These items presented in this section are brief summaries of sampling procedures.

6.2.1 Surface Soils

Surface soil samples will be collected using several different types of equipment. The specific sampling device is determined based upon: the depth of sample collection; quantity of sample required; type of analysis; and type of material being sampled.

Sampling utensils such as trowels, scoops, hand augers, and triers are routinely used to collect surface soil samples to a depth of 6 inches. Only stainless steel utensils will be used for sample collection. Once a sample has been collected using any one of these devices, the sample will be transferred directly in appropriate laboratory-supplied bottleneare for volatile organic analysis. The remainder will be transferred into a clean stainless steel bowl, mixed thoroughly and will then be placed into the appropriate bottleneare for organic and inorganic analysis as appropriate.

6.2.2 Subsurface Soils

6.2.2.1 Soil Borings

Subsurface soil samples will be collected from soil borings. Soil borings will be completed using a bucket auger, power auger or a drilling rig. Off-site samples will be collected from ground level to 0.5 feet BLS and from 0.5 feet BLS to 3.5 feet BLS directly from the bucket auger or from the split-spoon sampler if a drilling rig is used. A portion of the sample will be transferred in the appropriate bottleneare for volatile organic analysis using a clean stainless steel spatula. The remainder will be transferred into a clean stainless steel bowl, mixed thoroughly and will then be placed into the appropriate bottleneare for organic and inorganic analysis as appropriate.

On-site soil borings in Ponds 1,2,3,4,7 and the soil/sludge area beside Pond 2 will be conducted using a drill rig. Samples will be collected from these borings in 3 foot intervals. These borings will extend to bedrock or 9 feet into native soil below the pond bottoms whichever is less.

To determine which subinterval of each 3-foot interval will be submitted to the laboratory for volatile organics analysis, samples will be screened for volatile organics using an FID or PID. A portion of the sample from each 1-foot subinterval containing the highest FID or PID reading will be placed into a laboratory-supplied glass bottle for volatile organic analysis. If there is no observed difference in FID and PID readings, the second 1-foot subinterval will be collected as a grab for analysis for volatile organics and library searches for up to 15 compounds. The remainder of the entire 3-foot interval will be composited in a stainless steel bowl and placed into sample bottles for analysis for CLP non-volatile organics plus a library search for up to 25 additional compounds plus mirex, kepone, photomirex, and DPS, as well as for inorganic analysis as required.

6.2.2.2 Test Pits

Thirty test pits are planned on-site and in the swamp with additional pits to be located along the railroad tracks. The number and location of test pits along the railroad tracks will be based upon results of the soil gas survey.

A backhoe will open the test pits, and samples will be collected in undisturbed soils from the walls or from the base of the excavation. Equal volumes of each layer will be homogenized on an enamel pan with a stainless steel trowel prior to placing the appropriate volume in the sample container. The sample collected for volatile organic analysis will be collected as a grab sample from the center depth to avoid VOC loss during the homogenization process.

Sample acquisition of the test pit material will be dependent on the conditions encountered during digging the test pit. If safety conditions allow close proximity to the

test pit, and depths are not too great, a stainless steel bucket auger will be used to obtain the sample from the desired depth/location. If the above is not allowed, the sample will be obtained from material brought up by the bucket of the backhoe from the required depth. Samples will be obtained using a clean stainless steel spatula and transferred into appropriate bottleware.

6.2.3 Surface Water and Sediment Sampling

Most of the sediment samples will be collected using clean stainless steel utensils and dewatered as much as possible. Samples will be collected from the stream bottom to a depth of six to eight inches. Samples for volatile organic analysis will be placed directly in the appropriate bottleware. The remaining sample aliquot will be placed in a stainless steel bowl, thoroughly homogenized and placed into the appropriate bottleware.

Sediment samples collected from the bottom of Slanker Pond will be obtained using a clean Ponar^R dredge sampler from a small boat. This dredge is a clam shell scoop and is lowered into the pond on dedicated nylon rope until it reaches the bottom. The dredge closes and collects the sediment on contact with the pond bottom. The dredge is retrieved, opened and the sediment is transferred to the appropriate bottleware using a clean stainless steel spatula filling the containers for volatile organic analysis first.

At some of the sediment sampling locations, a surface water sample will be collected. Surface water sampling will proceed from the farthest downstream location and proceed to upstream locations to minimize potential cross-contamination from suspended material in the stream from sampling activities. Surface water samples will be collected before sediment samples. Dependent upon depth and stream velocity,

samples will be either collected directly into the appropriate sample containers at a point upstream of the samplers position or through the use of a long-handled polyethylene grab sampler from the bank of the stream.

Stream velocity and flow characteristics, pH, conductivity, DO and temperature will be noted at each sampling location. Stream velocity will be measured using a velocity meter (e.g. Pygmy). Flow will be determined based on the calculated cross-section area at the stream sampling station.

A water sample collected from the Slanker Pond will be obtained using a Kemmerer^R sampler. The sampler will be slowly lowered to the mid-depth of the water column and allowed to remain at that depth for several minutes. It will then be retrieved and the sample transferred to the appropriate bottleware, filling the vials for volatile organic analysis first.

6.2.4 Groundwater

Groundwater samples will be collected from numerous monitoring wells and several residential wells.

Prior to purging and sampling, the well protective casing, lock and apron will be inspected for damage or signs of tampering. Static water depth and total depth will be measured using a decontaminated probe with permanent depth markings. The static and total depth will be used to calculate the volume of standing water. One bailer of ground water from the top of the water column and one from the bottom of the well will be collected to detect immiscible layers before purging.

Where possible, at least three volumes will be removed prior to sampling. Less than this amount will be purged only if all standing water is removed before three volumes are purged.

Bailing or pumping methods will be used during purging to ensure that all standing water is removed. Purging will take place at the top of the water column where possible. Suction hoses for centrifugal pumps will be capped with a "foot valve" to prevent purged water from flowing back into the well as the hose is removed.

Sampling whenever possible will take place on the same day after purging procedures are completed. Where the well is purged dry, purging procedures are described in SSSP Appendix A, Section 2.1.

Samples will be collected from monitoring wells using Teflon^R bailers dedicated to each well. The first bailer withdrawn from the well will be checked for temperature, pH and specific conductance. Subsequent bailer volumes collected from within the screened interval will be used to directly fill sample bottles. Bottles intended for volatile organic compound analysis will be filled first, followed by the extractable organic fraction and finally the inorganic analysis bottles filled last.

Samples will be collected from five residential wells and the well at the country club. If possible, sampling points will be located at a water tap closest to the pump prior to any water softeners. Prior to sample collection, the faucet aerator, if any, will be removed and any in-line water conditioning units turned off. If the well is active, an appropriate volume of water in the supply line preceding the tap will be removed. An estimated three well volumes will be removed.

The sample will be collected after stabilization of temperature, pH, and conductivity. The sample will be collected directly from the tap into the sample containers.

If artesian flow conditions exist at any of the ground water sampling locations, the well will be allowed to flow until the appropriate amount of water is removed from the well prior to sample collection.

6.2.5 Fish Sampling

Fish species representing two trophic levels, upper and lower, will be collected from 28 sampling stations using one or more of the following types of equipment; electroshocker, fyke nets, seine nets, and gill nets. The fish collected at each station will be sorted by species, counted, weighed, measured, and recorded. One representative species from each trophic level will be selected for submission to the laboratory to be analyzed. The representative species, in order of preference is as follows; upper trophic level fish: bass, bluegill, crappie, and catfish; lower trophic level fish: carp, sucker, chubs, and bullheads. The upper trophic level species will be filleted in the field with skins on, using a stainless steel knife in a stainless steel pan. The fillets will be combined and wrapped accordingly. The lower trophic level fish will be packaged as whole fish. Total fish weight will be a minimum of 150 grams per species per sampling location.

6.2.6 Air Sampling

In addition to the sampling of air (and particulates) for quantitative laboratory analysis of various organic pollutants, field monitoring of air will also be performed utilizing FID and PID (soil gas survey) and an explosimeter.

The specific sampling protocol for these field measurements are provided in the Site Specific Sampling Plan (SSSP) (Volume 3).

6.2.6.1 Century OVA Meter 128 and HNU Model P1 101
Photoionization Meter

A survey of the Site using flame ionization (FID) and photoionization (PID) detectors will be completed prior to the initiation of any field work. The survey will define specific work zone boundaries identified in the Health and Safety Plan, and identify areas with elevated levels of volatile organic compounds that may also require inclusion as an exclusion area. Measurements of VOCs at ground surface and three feet above ground surface using the PID and FID will be made at 100 foot intervals along the site boundaries at stations, around each pond at stations every 50 feet, and at several locations within the proposed clean support zone. The area between discrete sampling points will be walked with the instrument operating in order to detect any unexpected elevated levels of volatile compounds. The work and exclusion zones around each test pit excavation, boring or well drilling location will be screened during site work using a PID and/or FID to determine proper health and safety protection. All measurements at discrete monitoring stations will be recorded in the field log book along with location, time and area weather condition. If no elevated levels of volatiles are detected during the walk through between discrete monitoring stations using the organic vapor meter (FID) and/or the photoionization instrument (PID), only the concentration measured at discrete monitoring stations will be individually recorded in the field notebook. Subsurface soil borings will be screened with an OVA in order to provide information as to what soil boring interval will be selected for quantitative analysis. Weather condition (wind speed, wind direction, temperature, etc.) will also be obtained from

a local weather bureau. Wind rose data collected at the nearest weather station will be included in the RI report.

6.2.6.2 Tenax, XAD-2, and CMS Trap Sampling

There will be three phases to the volatile/semivolatile sampling program. In general, volatiles will be trapped by drawing ambient air through a cartridge containing one to two grams of Tenax (EPA Method TO1 "Method for the Determination of Volatile Organic Compounds in Ambient Air Using Tenax Adsorption and for Gas Chromatography/Mass Spectrometry"). Highly volatile compounds will be trapped by drawing ambient air through a cartridge containing approximately 0.4 grams of carbon molecular sieve (CMS) adsorbent. Semivolatile compounds will be trapped by drawing ambient air through XAD-2 adsorbent traps. The sample flow rate and sample volume (and thereby sampling time) will be dependent upon the ability of the adsorbent to trap the organic compounds (retention volume) and other properties of the organic compound (polarity, boiling point, etc.). Enseco will conduct method validation studies for this project. Flow rates will be maintained by flow controllers. Appropriate sampling pumps will be utilized. At a minimum samples will be collected at the following sites:

1. Off-site upwind
2. Off-site downwind
3. Pond 1 downwind
4. Pond 2 downwind
5. Pond 7 downwind
6. Between the leachate collection system and the railroad tracks.

On-site samples will be collected at a height of 3 feet while the sampling height will be at a level of 5 to 6 feet above ground level for off-site samples (ambient breathing zone).

6.2.6.3 High Volume Particulate Sampling

Air is drawn into a covered housing and through a filter by means of a high-flow-rate blower at a flow rate (1.13 to 1.70 m³/min.; 40 to 60 ft³/min.) that allows suspended particles having diameters of less than 100 um. to pass to the filter surface. Particles within the size range of 100 to 0.1 um. diameter are ordinarily collected on glass fiber filters. The mass concentration of suspended particulates in the ambient air (ug/m³) is computed by measuring the mass of collected particulates and the volume of air sampled.

When the sampler is operated at an average flow rate of 1.70m³/min. (60 ft³/min.) for 24 hours, an adequate sample will be obtained even in an atmosphere having concentrations of suspended particulates as low as 1 ng/m³. If particulate levels are unusually high, a satisfactory sample may be obtained in 6 to 8 hours or less. For determination of average concentrations of suspended particulates in ambient air the sampling period will be 24 hours.

Weights are determined to the nearest 0.1 milligram, airflow rates are determined to the nearest 0.01 m³/min. (1.0 ft³/min.), times are determined to the nearest 2 minutes, and mass concentrations are reported to the nearest microgram per cubic meter.

Samples will be collected by opening the shelter, installing a numbered, preweighed, glass-fiber filter in position (rough side up), replacing the faceplate without disturbing the filter, and securely fastening the wing nuts.

After the 24-hour sampling period, the filter is carefully removed from the holder, touching only the outer edges. The filter is folded lengthwise so that only surfaces

with collected particulates are in contact, and the filter is placed in a manila folder. The filter number, sampler location, and any other factors, such as meteorological conditions or razing of nearby buildings, is recorded on the folder.

The objective of this sampling (particulate) is to obtain particulate data which may be used in a health risk assessment study of the site; therefore, samples will be taken from a height of 3 feet on-site, and 5 to 6 feet off-site. Representative areas of the site will be sampled; that is, the sampling will attempt not to be biased toward worst or best case scenarios. An upwind sample will be obtained, as will downwind samples near the boundary lines.

6.2.6.4 Organochlorine Pesticide and PCB Sampling

Sampling utilizing instrumentation and procedures specified in EPA Method TO4 (Method for the Determination of Organochlorine Pesticides and Polychlorinated Biphenyls in Ambient Air) will be used. Samples will be collected from the six sampling sites denoted previously. In this method, a modified high volume sampler consisting of a glass fiber filter with a polyurethane foam (PUF) backup adsorbent cartridge is used to collect ambient air at a rate of 200 to 280 liters/minute. The filter and PUF cartridge will each be analyzed for TCL organochlorine pesticides and PCBs as well as mirex, photomirex and kepone. Two sampling units will be used during sampling activities.

6.3 Sample Packing, Handling and Shipment

After a given sample has been collected, a self-adhesive label will be prepared with indelible ink and affixed to each container. At a minimum, the sample label will contain:

- o The Investigation Name (Ruetgers-Nease - RI/FS)
- o Field Sample Number (Section 5.2 of SSSP)
- o Sample Description
- o Date and Time Collected
- o Sampler's Initials
- o Testing Required
- o Preservatives Added.

Immediately after sample collection, each labeled sample container will be sealed in an individual plastic bag. Samples will then be placed immediately into an insulated cooler with ice or ice packs for shipment to the laboratory. Fish samples will be wrapped in clean aluminum foil, sealed in a plastic bag and packed in a separate cooler with dry ice.

Sorbent traps (Tenax, XAD-2, and CMS) will be stored in individual glass culture tubes. These will then be stored in friction top cans containing a layer of charcoal on the bottom. These cans will be placed in a separate cooler for shipment to the laboratory.

The PUF plug is placed into the glass sampling cartridge using polyester gloves after initial cleaning. The module is wrapped in clean aluminum foil, placed in a labeled container and tightly sealed. The process is repeated after sampling. The filter is stored in cleaned petri dishes.

The hi-volume particulate filters are stored in manila folders prior to and after sampling.

Chain-of-custody aspects of sample handling are discussed in detail in Section 6.6. These records are sealed in ziplock bags to protect them against moisture and will be taped to the underside door of appropriate sample coolers. Each cooler will contain sufficient ice and /or ice packs to insure that proper temperature is maintained, and will be packed in an appropriate packing material (e.g. vermiculite) to prevent damage to sample containers.

The sample coolers will be shipped by an overnight courier according to current U.S. DOT regulations.

6.4 Sample Containers, Preservatives and Holding Times

The specific containers, preservatives and holding times that will be utilized for this investigation are presented on Table 6-1.

6.5 Preparation of Sampling Equipment and Containers

6.5.1 Decontamination of Sampling Equipment

This section describes procedures for decontaminating drilling and sampling equipment. Detailed personnel decontamination procedures are discussed in Section 9.0 of the Health and Safety Plan. Decontamination protocols will be strictly adhered to in order to minimize the potential for cross-contamination between sampling locations and contamination of off-site areas.

QAPP Table 6-1
Sample Containers, Preservatives, and Holding Times*

Analysis	Matrix	Container And Volume ¹	Preservative	Maximum Holding Time ²
Semivolatiles, Dichloronitro benzene and Diphenyl Sulfone	Aqueous	(2) Glass, amber 1/2 gal with teflon lined caps (filled to shoulder)	None, cool, 4°C	5 days extrn./40 days anal.
	Solid	(1) Glass, amber 8 oz. jar with teflon lined caps	None, cool, 4°C	10 days extrn./40 days anal.
	Fish	Aluminum foil	None, cool, 4°C	10 days extrn./40 days anal.
	Air	XAD canister	None, cool, 4°C	10 days extrn./40 days anal.
Dioxins and Furans	Aqueous	(2) Glass, amber, 1/2 gal. with teflon lined caps	pH 6-8 with either NaOH or H ₂ SO ₄ , cool, 4°C	5 days extrn./40 days anal.
	Solid	(1) Glass, amber, 8 oz. with teflon lined caps	None, cool, 4°C	10 days extrn./40 days anal.
Volatiles	Aqueous	(3) 40 ml VOA vials teflon lined caps (no headspace) ³	HCl to pH2, cool, 4°C	10 days anal. (7 days anal. ⁴)
	Solid	(2) 120 ml glass vials with teflon lined caps (filled to shoulder)	None, cool, 4°C	10 days anal.
	Fish	Aluminum foil	None, cool, 0°C	10 days anal.
	Air	Tenax and CMS Tubes in cans with carbon	None, cool, 4°C	10 days anal.
Pesticides/PCBs	Aqueous	(2) Glass, amber, 1/2 gal. with teflon lined caps	pH adjusted to 5-9, cool, 4°C and preserve with 0.008% Na ₂ S ₂ O ₃	5 days extrn./40 days anal.
	Solid	(1) Glass, 8 oz. jar with teflon lined caps	None, cool, 4°C	10 days extrn./40 days anal.
	Fish	Aluminum foil	None, cool, 0°C	10 days extrn./40 days anal.
	Air	Foam canister (PUF)	None, cool, 4°C	10 days extrn./40 days anal.
Mirex, Photomirex, Kepone	Aqueous	(2) Glass, amber, 1/2 gal. with teflon lined caps	None, cool, 4°C	5 days extrn./40 days anal.
	Solid	(1) Glass, 8 oz. jar with teflon lined caps	None, cool, 4°C	10 days extrn./40 days anal.
	Fish	Aluminum foil	None, cool, 0°C	10 days extrn./40 days anal.
	Air	Foam canister	None, cool, 4°C	10 days extrn./40 days anal.
Metals, except Mercury	Aqueous	(1) Polyethylene, 1 liter with teflon lined caps	HNO ₃ to pH<2	6 mos.
	Solid	(1) Glass, 8 oz. jar with teflon lined caps	None, cool, 4°C	6 mos.
Cyanide	Aqueous	(1) Polyethylene, 1 liter with teflon lined caps	NaOH to pH>12	14 days
	Solid	(1) Glass, 8 oz. jar with teflon lined caps	None, cool, 4°C	14 days
Mercury	Aqueous	(1) Polyethylene, 1 liter with teflon lined caps	HNO ₃ to pH<2	26 days
	Solid	(1) Glass, 8 oz. jar with teflon lined caps	None, cool, 4°C	26 days

NOTES:

* From date of validated time of sample receipt (VTSR) at the analysis laboratory

* Reference: U.S. EPA's CLP Statement of Work for Organics, Inorganics and Dioxins/Furans (SOW 887).

¹ Triplicate the sample volume must be submitted to the laboratory for samples designated as matrix samples/matrix sample duplicates.

² All samples will be shipped by overnight delivery to the laboratory except on occasions of late night or Sunday sampling. On these occasions, refrigeration will occur on-site for any samples requiring this preservation and will be shipped at the next available time. However, the next available sample shipment day will not exceed more than one day after sample collection. It is understood that samples shipped out on Saturday will not be received by the laboratory until Monday.

³ The VOA samples collected from the residential well will require four 40 ml VOA vials with teflon lined caps.

⁴ The VOA holding time for residential wells will be 7 days.

extrn: extraction
anal: analysis

6.5.1.1 General Considerations

The following general procedures will be adhered concerning decontamination efforts:

1. All decontamination and subsequent use of decontaminated equipment will be documented in a field book.
2. If visual signs such as discoloration indicate that decontamination was insufficient, the equipment will again be decontaminated. If the situation persists, the equipment will be taken out of service until the situation can be corrected.
3. All spent wash and rinse waters will be collected and stored in an on-site tank pending analysis and proper disposal.
4. Verification of the sampling equipment cleaning procedures will be documented by the collection of field blanks and trip blanks.
5. Drill cuttings from off-site locations will be containerized and handled according to procedures described in Section 9.4 of the Health and Safety Plan (Volume 4).
6. All properly decontaminated equipment will be stored in plastic bags when not in use.
7. All fluids and solids generated from sample location decontamination will be transported and disposed according the Hazardous Materials

Handling procedures described in the Health and Safety Plan, Section 9.4.

8. Personnel and equipment will proceed directly to the decontamination pad between sample locations and at the end of each day.

6.5.1.2 Heavy Equipment

Drill rigs, backhoe buckets, and appropriate other heavy equipment will be decontaminated prior to the commencement of field activities, between each sample location, and after the completion of field activities at the on-site decontamination pad. Decontamination procedures will be as follows:

1. Remove all loose soil from equipment with a brush.
2. Steam or high pressure wash using non-phosphate soap.
3. Potable water rinse.

6.5.1.3 Drilling Equipment

Drilling equipment (i.e., rods, auger flights, bits, casings) will be cleaned between each boring location and sample. Decontamination procedures will be as follows:

1. Remove all loose soil.
2. Steam or high pressure wash using non-phosphate soap.
3. Potable water rinse.

All wash water will be stored in an on-site tank pending proper disposal. All soil will be containerized.

All cleaned equipment will be transported and stored in plastic sheets.

6.5.1.4 Sampling Equipment

Equipment used to collect environmental samples will be cleaned prior to its initial use and between each sample location and after the final use. All equipment will be transported and stored in plastic sheets.

6.5.1.4.1 Soil and Sediment Sampling Equipment

Soil sampling equipment will be decontaminated at the sample locations. Equipment that will be cleaned will include: split spoons, Shelby Tubes, hand augers, stainless steel scoops/trowels, and stainless steel compositing containers. Specific procedures are as follows:

Inorganics

1. Non-phosphate
detergent wash
2. 0.1 N HCL rinse
3. Tap water rinse
4. Deionized water rinse
5. Air dry

Organics

1. Non-phosphate
detergent wash
2. Tap water rinse
3. Deionized/Distilled
water rinse
4. Methanol rinse
5. Pesticide quality
hexane rinse
6. Methanol rinse

7. Four rinses with
deionized/distilled
water

8. Air dry

6.5.1.4.2 Ground Water and Surface Water Sampling

Equipment used for ground water and surface water sampling will be decontaminated before sampling activities begin and between each sample location if dedicated equipment is not used. This equipment will include: pumps, hoses, glass beakers and bailers. The following procedures will be used for decontaminating equipment:

Inorganics

1. Non-phosphate
detergent wash
2. 0.1 N HCL rinse
3. Tap water rinse
4. Deionized water rinse
5. Air dry

Organics

1. Non-phosphate
detergent wash
2. Tap water rinse
3. Deionized/Distilled
water rinse
4. Methanol rinse
5. Pesticide quality
hexane rinse
6. Methanol rinse

7. Four rinses with
deionized/distilled
water

8. Air dry

6.5.1.4.3 Fish Sampling Equipment

Sampling equipment such as the fish shocker, fyke net, seine net, and gill nets will be rinsed off with potable water after each station to minimize cross-contamination.

6.5.1.4.4 Soil Gas Probe

The soil gas probe used during the survey will be decontaminated using the procedures specified below:

1. Remove loose soil.
2. Non-phosphate soap wash.
3. Potable water rinse.
4. Deionized water rinse.
5. Field scan with FID.

6.5.1.4.5 Temperature, Conductivity, pH, and Depth to Water Probes

These probes used during ground water and surface water sampling will be decontaminated via the procedures specified below:

1. Wash with non-phosphate detergent solution.

2. Potable water rinse.
3. Deionized water rinse.

All equipment will be transported and stored in plastic sheeting.

6.5.1.5 Monitoring Well Materials

Well screens, riser pipes, and outer casings will be steam cleaned at the decontamination area, wrapped in plastic sheeting, and stored in the on-site warehouse building.

6.5.1.6 Electronic Equipment

Electronic equipment such as PIDs, FIDs, explosimeters, and portable air pumps will be decontaminated prior to their initial use and at the end of each day. The procedure for decontaminating this equipment is as follows:

1. Remove particulate contamination.
2. Wipe down with clean damp cloth (deionized water).
3. Air dry.

Equipment will be wrapped in plastic and stored in the office trailer when not in use.

6.5.2 Preparation of Sample Containers

Enseco will provide appropriately prepared sample containers and coolers for this project. All containers for volatile organics, extractable organics, and inorganics are purchased, precleaned and prebaked from I-Chem of Hayward, CA. Enseco purchases 200 Series bottles which are cleaned

for the specific analyses according to U.S. EPA specifications. Preservation using ultra-pure reagents, if necessary, will be done prior to container shipment. The following are preservation techniques applicable to this project.

Volatile organics -- water 0.2 ml 1:1 HCL (pH ≤ 2)

Metals -- water 2.5 mls 1:1 HNO₃ (pH ≤ 2)

Cyanide -- water 7-10 pellets NaOH (pH ≥ 12)

6.5.2.1 Air Tube Preparation

For initial cleanup, the PUF plug is placed in a Soxhlet extractor and extracted with acetone for 14-24 hours at approximately 4 cycles per hour. If cartridges are reused, 5% diethyl ether in n-hexane will be used as the cleanup solvent.

The extracted PUF is placed in a vacuum oven connected to a water aspirator and dried at room temperature for approximately 4 hours. The PUF is placed into the glass sampling cartridge using polyester gloves. The module is wrapped with aluminum foil, placed in a labeled container and tightly sealed.

6.5.2.1.1 Method TO1

Bulk Tenax is placed in a glass extraction thimble and held in place with a plug of clean glasswool. The resin is then placed in the soxhlet extraction apparatus and extracted sequentially with methanol and then pentane for 16-24 hours (each solvent) at approximately 6 cycles/hour. Glasswool for cartridge preparation will be cleaned in the same manner as Tenax.

The extracted Tenax is immediately placed in an open glass dish and heated under an infrared lamp for two hours in a hood. Care will be exercised to avoid overheating of the Tenax by the infrared lamp. The Tenax is then placed in a vacuum oven (evacuated using a water aspirator) without heat for one hour. An inert gas (helium or nitrogen) purge of 2-3 ml/minute is used to aid in the removal of solvent vapors. The oven temperature is then increased to 110°C, maintaining inert gas flow and held for one hour. The oven temperature control is then shut off and the oven is allowed to cool to room temperature. Prior to opening the oven, the oven is slightly pressurized with nitrogen to prevent contamination with ambient air. The Tenax is removed from the oven and sieved through a 40/60 mesh sieve (acetone rinsed and oven dried) into a clean glass vessel.

The cartridge is packed by placing a 0.5-1cm glasswool plug in the base of the cartridge and then filling the cartridge to within approximately 1 cm of the top. A 0.5-1cm glasswool plug is placed in the top of the cartridge.

The cartridges are then thermally conditioned by heating for four hours at 270°C under an inert gas (helium) purge (100-200 ml/min).

6.5.2.1.2 Method T02

The carbon molecular sieve cartridges are conditioned for initial use by heating at 400°C overnight (at least 16 hours) with a 100 mL/minute purge of ultra-pure nitrogen. Reused cartridges need only to be heated for 4 hours.

For cartridge conditioning ultra-pure nitrogen gas is passed through a gas purifier to remove oxygen, moisture and organic contaminants. The nitrogen supply is connected to

the unmarked end of the cartridge and the flow adjusted to 50 mL/minute using a needle valve. The gas flow from the inlet (marked) end of the cartridge is vented to the atmosphere.

After 10-16 hours of heating (for new cartridges) the Variac is turned off and the cartridge is allowed to cool to 30°C, under continuing nitrogen flow.

The exit end of the cartridge is capped and then the entire cartridge is removed from the flow line and the other endcap immediately installed. The cartridges are then placed in a metal friction top (paint) can containing 2 inches of granulated activated charcoal (to prevent contamination of the cartridges during storage) in the bottom, beneath a retaining screen. Clean paper tissues (e.g. Kimwipes) are placed in the can to avoid damage to the cartridges during shipment.

6.5.2.1.3 XAD-2

The XAD-2 is placed in a glass extraction thimble and held in place with a plug of clean glasswool. The resin is then placed in the soxhlet extraction apparatus and extracted with methylene chloride for 16-24 hours at 6 cycles/hour. Glasswool is cleaned in the same manner. XAD-2 is stored in methanol until the tube is packed.

6.6 Documentation of Sampling Activities

In order to ensure that all pertinent information and data collected during the RI/FS are documented completely and correctly, the following procedures and protocols described in the following sections will be implemented.

6.6.1 Log In/Log Out Record

A sign-in/sign-out log will be kept at the office trailer for use by authorized personnel. Unauthorized personnel will not be granted access on site unless approved by Ruetgers-Nease, in advance. The record will contain at a minimum: date, name, organization, and entrance/exit times.

6.6.2 Field Notebooks

All information pertinent to the field investigation will be recorded in bound and numbered field notebooks. Each team member will be assigned an individual notebook. Field records should at a minimum contain the following information:

1. Date
2. Time of each data entry
3. Description of work being performed that day
4. Names and affiliations of all personnel at location
5. Weather conditions on-site
6. Location and type of activity (monitoring well, surface water sample, etc.)
7. Sample or Boring Methods in use
8. Visual observations
9. Pertinent field data (pH, specific conductance, temperature, and any other field measurements such as from a FID or Explosimeter)

10. Serial numbers, if any, on seals and transportation cases
11. Name of field custodian
12. Photographs taken, including date, time, direction faced, description of subject or activity, sequential numbers of the photos and film roll numbers.

All field notebooks will be standard engineering hardbound books. All field notebooks will be photocopied so that copies of field notes can be kept. An example of some typical field notebook entries are presented on Figure 6-1.

6.6.3 Sample Log Book

Specific sample information will be compiled into one sample log notebook. The following information will be included in the sample log notebook:

1. Unique Sample number (See Section 5.2 of SSSP)
2. Sample Date
3. Sampler's Initials
4. Sample Matrix (soil, water, etc.)
5. Number of samples
6. Analyses previously performed
7. Current analyses requested
8. Date shipped to the lab
9. Method of shipment

FIGURE QAPP 6-1

Typical Logbook Entries

Acme Waste Company

Joe Smith-EPA Region V (315) 672-3396
 Marin Astare-PADER (717) 629-3396
 Peter Shoperton-Site Owner (215) 276-9377
 Paul Detchik-Project Manager (215) 687-9560
 Joe Perryton-Geologist (215) 687-9560
 Pauline Jenlan-Sampler (215) 687-9560

Checked out traffic reports 1600-1607 with 3 chain of custody
 8/25/87 - bottles delivered by lab courier 8/22/87. JP took
 bottle custody. Arrived on site 8/27/87 @ 11:00. Cool (57F),
 Sunny, Entire site on a slight slope to the north. Met Joe Smith,
 Marin Astare & Peter Shoperton for site recon.

OVA Background Levels Oppm. Stable

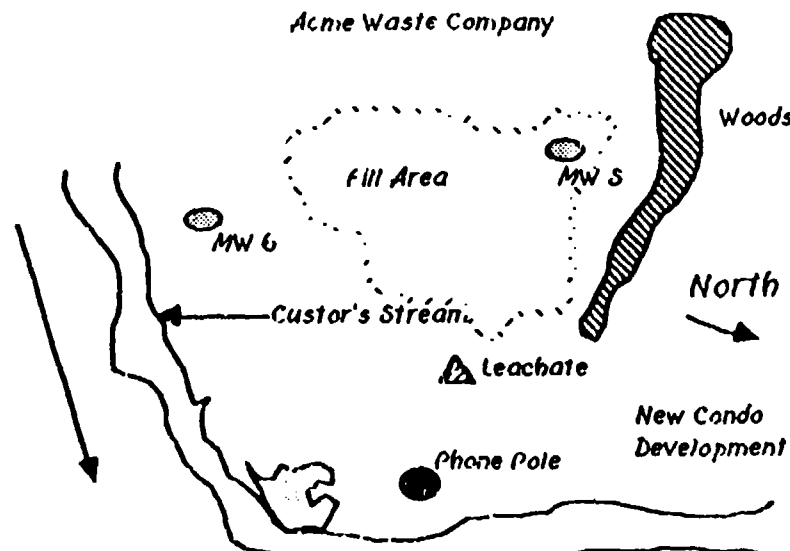
-OVA calibrated 8/25/87 see log entry page 2

12:10 Pauline sampling leachate TR 1601 photo 3, sample
 smells like sulfur and is rainbow in color with an oily sheen.
 Leachate was observed 3 feet west of the phone on site.

12:50 Joe P. samples a seep at the base of Custor's Stream
 TR 1602 seep is bright red and has the viscosity similar to
 motor oil, Photo 4.

page 3

Paul Detchik



13:00 Paul is purging Monitoring well #5 while Joe is preparing
 to collect a grab sample.

14:00 Joe is bailing the well #5 and @ 14:13 is filtering for
 metals (dissolved).
 Sample acidified w/ HNO₃ pH < 2 after filtration was complete
 TR 1603 Photo 5

15:30 Sampling from well #5 completed in triplicate so an MS
 and MSD can be submitted for well #5, (1604-MS, 1605-MSD)

16:50 Team left site.

Paul Detchik

6.6.4 Photo-Documentation

All photographers will record time, date, site location, general direction faced, sequential number of photograph and roll number, and brief description of the subject in a field notebook.

6.6.5 Correspondence/Communications

All documents including field notes will be copied at the field office once a week and will be checked for completeness and filed. Filing cabinets will hold files in the field office. All correspondence received or sent from the field office will be dated and labeled with a project filing identification control number. All telephone conversations will be documented and filed.

6.7 Summary of Sampling and Analysis

This section provides a summary of the number of samples from each medium that will be collected, what parameters will be analyzed for these samples and the frequency and type of both field and laboratory QC that will be instituted.

6.7.1 Quality Control Samples

Duplicate or replicate samples, as well as field (prepared in the field) and trip (prepared in the laboratory) blanks will be collected and submitted to the analytical laboratories to provide an assessment of the quality of sampling activities and results. Field duplicate samples are samples that have been homogenized and divided into two or more portions at some step in the measurement process and submitted to the laboratory as unique independent samples. These samples will be analyzed to monitor analytical

precision. Since homogenization will not yield acceptable data for volatile organics, duplicates will not be performed for volatile organics. Instead, replicates will be collected for this fraction. Field replicates are separate grab samples collected from one sample location. Replicates are not homogenized. These samples will be analyzed to monitor sample representativeness. Field blank samples will be analyzed to check for procedural contamination which is a function of accuracy. Field blank sampling involves the use of deionized, laboratory supplied water which is either poured over or passed through sampling devices. Field blanks for air cartridges involve opening the cartridges on-site and allowing the materials to passively absorb any ambient contaminants. The location of the air field blank will be upwind of the site. Performance Evaluation (PE) samples will be supplied by the U.S. EPA to accompany samples for dioxin and furan analysis. Once dioxin and furan data has been received, ERM's QA Manager will request the 95% confidence interval results from the U.S. EPA for inclusion as part of ERM's quality assurance reviews. PE samples provide an excellent indication of analytical accuracy.

To confirm the level of cleanliness of the bottles, laboratory personnel will prepare the appropriate trip blanks by filling two VOA sample bottles per shipment container with organic free water. Trip blanks for air samples are sealed cartridges which are prepared by the laboratory, sent to the site, and returned with project samples for analysis. Frequencies for collecting field QA samples and the required types and numbers of laboratory QC samples are presented on Table 6-2. Although field blanks and trip blanks are not required for the collection of soil samples, they will be submitted as a qualitative indication of contamination.

QAPP Table 6-2
Sampling, Analysis: A Sample Summary

Matrix	Field Parameters	Number of Samples	Chemical Analysis									OA Samples						Performance Evaluations(2)			Matrix Spike (4)			Total Matrix
												Replicates			Field Blanks(1)									
			A(3)	B	C	D	E	F	G	H	I	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	
Test Pit Soil(7)	Qualitative organic screening with OVA and/or HNu	105	87	18								11	1	11	6	1	6	1	1	1	6	2	12	135
Borings Soil(7)	Qualitative organic screening with OVA and/or HNu	93			42	22	17	12				10	1	10	8	1	8	0	0	0	5	2	10	121
Non-Native Borings Solids(7)	Qualitative organic screening with OVA and/or HNu	41	16	13					9		3	5	1	5	3	1	3	1	1	1	3	2	6	56
Sediments & Native Soils	Qualitative organic screening with OVA and/or HNu	89	14			22				18	35	10	1	10	6	1	6	0	0	0	5	2	10	115
Ground water (MW)(5)(6)(8)	pH, spec cond, temp, DO	66	62	4								7	1	7	4	1	4	1	1	1	4	2	8	86
Ground water (residential)(6)	pH, spec cond, temp, DO	6	6									1	1	1	1	1	1	0	0	0	1	2	2	10
Surface water(6)	pH, spec cond, temp, DO	26	12			14						3	1	3	3	1	3	0	0	0	3	2	6	38
Fish(7)	Weight, size	56	10			46						6	1	6	0	0	0	0	0	0	3	2	6	68
Air/particulates(7)	Qualitative organic screening with OVA and/or HNU	6	6									1	1	1	1	1	1	0	0	0	1	2	2	10

A = TCL volatile organics (+15), TCL nonvolatile (+25), mirex, kepone, photomirex, DPS*

B = TCL organics (+40), TCL inorganics, mirex, kepone, photomirex, dioxins/furans, 3,4-DCNB and DPS*

C = TCL volatile organics (+15), mirex, kepone, photomirex, methoxychlor, DPS*

D = TCL nonvolatile organics (+25), mirex, kepone, photomirex, DPS*

E = TCL nonvolatile organics (+25)

F = Physical parameters: soil classification, specific gravity, permeability, effective porosity, particle size, moisture content, and Atterburg limits

G = Mirex, Photomirex, Kepone, DPS*

H = Mirex, Photomirex, Kepone, DPS* & Methoxychlor

I = TCL organics (+40), TCL inorganics, mirex, kepone, photomirex, 3,4-DCNB and DPS*

* 3,4-Dichloronitrobenzene (DCNB) and/or diphenyl sulfone (DPS) will be analyzed as part of the semivolatile fraction

Notes:

- Based on Table 3-6; The number of blanks may be more depending on the number of samples collected per day. Although field blanks and trip blanks are not required for soil samples, they will be submitted as a qualitative indication of contamination.
- Performance evaluation and samples will be supplied by USEPA for Dioxin/Furan analysis (one per batch)
- The volatile analysis of air will be TCL (+15) minus the four ketones on the VOA TCL
- Matrix spikes will also be performed for mirex, kepone, photomirex, diphenyl sulfone, and DCNB
- This number includes only Round 1 groundwater samples
- Trip blanks will also be submitted one per cooler of aqueous samples for the analysis of TCL VOAs +15
- Trip blanks will be submitted one per 20 samples.
- Dedicated sampling equipment will be used for each monitoring well.

7.0 SAMPLE CUSTODY

7.1 Field Activities Sample Custody

The primary objective of sample custody procedures is to create an accurate written record which can be used to trace the possession and handling of all samples from the moment of their collection, through analysis, until their final disposition. Sample custody for samples collected during this investigation will be maintained by the Field Operations Manager (FOM) or the field personnel collecting the samples. The FOM or field personnel are responsible for documenting each sample transfer and maintaining custody of all samples until they are shipped to the laboratory.

All necessary sample bottles will be shipped to ERM or the field office by Enseco Laboratories and received by the FOM or field personnel. All necessary chemical preservatives will be added to the bottle by Enseco. Sample bottles needed for a specific sampling task will then be relinquished by the FOM to the sampling team after the FOM has verified the integrity of the bottles and assured that the proper bottles have been assigned for the task to be conducted.

Immediately after sample collection and bottle labeling, each sample container will be sealed in an individual plastic bag and stored in an on-site refrigerator at 4°C until packaging for shipment to the laboratory occurs. Samples will be removed from the on-site refrigerator and will then be placed immediately into an insulated cooler with "Blue Ice" and packing materials (e.g. vermiculite) for shipment to the laboratory. ERM field Chain-of-Custody records (Figure 7-1) completed at the time of sample collection will accompany the samples inside the cooler for shipment to the laboratory. The samples will be properly relinquished on the

FIGURE QAPP. 7-1



ERM-Midwest, inc.
2000 West Henderson Road/Columbus, OH 43220

CHAIN OF CUSTODY RECORD

Project No./I.D. _____ Sheet _____ of _____
Sampled By _____ Bottles Supplied By _____
NOTE: When analyses are complete return this form to:
Name: _____ @ ERM-Midwest, Inc., Columbus, Ohio

Sample I.D.	Sample Description	Collection Date/Time	No. of bottles	Analysis Requested	Remarks

Shipping package opened by: _____ Date: _____ Time: _____
Employer: _____ Containers intact (Y/N) _____

Samples packaged & sealed by: _____ Date: _____ Time: _____
Employer: _____ Method of Shipment: _____

Received in laboratory by: _____ Date: _____ Time: _____
Employer: _____ Seals intact (Y/N) _____
Containers intact (Y/N) _____ If not, describe in Comments section

NOTE: Laboratory's Chain of Custody shall be in effect from receipt through analysis.

Relinquished By		Received By		Samples Intact	Date	Time	Initials	
Name	Employer	Name	Employer				Sender	Rec'r

COMMENTS:

Copies: White - Project file; Yellow - Client; Pink - Sampler

field Chain-of-Custody record by the sampling team. These record forms will be sealed in a ziplock plastic bag to protect them against moisture. The coolers are then sealed utilizing custody seals (Figure 7-2).

Prior to releasing the coolers, the FOM will require the courier to sign an ERM Cooler Transfer Acknowledgment (Figure 7-3). All sample coolers will be delivered to the analytical laboratory by either direct courier or 24-hour delivery courier (i.e., Federal Express).

7.2 Enseco Sample Custody

The laboratory chain-of-custody begins when containers are sent from the laboratory. While on site, sample containers are always under the personal custody of a member of the sampling team or are secured in sealed coolers. Upon completion of sampling, samples are appropriately labeled. The Enseco sample label is included as Figure 7-4. The samples are then stored in sealed containers and shipped to Enseco with a completed chain-of-custody record (Figure 7-5).

Samples are received by the Enseco sample manager, who records and files all shipping documentation. A copy of the Enseco's shipping log is presented as Figure 7-6. Shipments are then directed to the Sample Custodian. Internal chain-of-custody begins as the samples are received by this custodian. The coolers are inspected for proper seals and labels. Contents are removed and coordinated with packing lists and chain-of-custody records. The samples are logged into the computerized sample tracking system by completing a sample receiving form (Figure 7-7). This form is used to assign Enseco identification numbers to the samples and document their condition. This number consists of the booking number followed by a chronological number for each

FIGURE QAPP 7-2

ERM Custody Seal

ERM	OFFICIAL CUSTODY SEAL	Name: _____ Date : _____
------------	----------------------------------	-----------------------------

ERM COOLER TRANSFER ACKNOWLEDGEMENT

DATE TIME	CLIENT / PROJECT CLIENT NUMBER	NUMBER OF COOLERS	ERM RELEASE (SIGNATURE)	RECEIVED BY (SIGNATURE)	DATE TIME

FIGURE QAPP 7-3
ERM COOLER TRANSFER
ACKNOWLEDGEMENT

VOLUME 2: QAPP
SECTION 7
REV.4/Feb.1990

FIGURE QAPP 7-4
ERCO SAMPLE LABEL

VOLUME 2: QAPP
SECTION 7
REV.4/Feb.1990

ERCO A DIVISION OF **ENSECO** INCORPORATED
205 Alewife Brook Parkway, Cambridge, Massachusetts 02138 (617) 661-3111

Sampler _____ Date _____ Time _____

Sample Identification: _____

Preservatives: _____

Analysis: _____

FIGURE QAPP 7-5
ENSECO CHAIN OF CUSTODY RECORD

Enseco

CHAIN-OF-CUSTODY RECORD

SAMPLER: (Signature) _____ Date Shipped _____ Carrier _____
Phone _____ Airbill No. _____ Cooler No. _____

SHIP TO: Enseco-ERCO Lab SEND RESULTS TO:
205 Alewife Brook Parkway Client Name _____
Cambridge, MA 02138 Company _____
(617) 661-3111 Address _____
ATTENTION: _____ Phone _____

PROJECT NAME _____ PROJECT NO. _____ P.O. NO. _____

Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Received at lab by: (Signature)	Date	Time
Relinquished from lab by: (Signature)	Received by: (Signature)	Date	Time

ANALYSIS REQUEST

Sample ID Number	Sample Description	Date/Time Sampled	Analysis Requested	Sample Condition Upon Receipt

Special Instructions, Comments:

NOTE: UNUSED PORTIONS OF NON-AQUEOUS SAMPLES WILL BE RETURNED TO CLIENT
Expected Analytical Immediate
T.A.T's: _____ Attention (200% surcharge) _____ RUSH (\$0-100% surcharge) _____ Standard

ERCO Booking Log Number: (for lab use only)

Client Retains White Copy Only

(Revised 1/87)

FIGURE QAPP 7-6 .

Erco Shipping Log - Incoming

Page [illegible]

FIGURE QAPP 7-7
SAMPLE RECEIVING FORM

Booking Log No.: _____

Enseco - Erco Laboratory

Client: _____																	
Client Project: _____		Date Received: _____															
Program Mgr.: _____		Date Due: _____															
<p style="text-align: center;">Reporting Format (Please Circle)</p> <table style="width: 100%;"> <tr> <td>CLP</td> <td>Tier I A, B</td> <td>Tier II A, B</td> <td>ECRA</td> <td>RCRA</td> </tr> <tr> <td>HSL</td> <td>PP</td> <td>Unknowns <input type="checkbox"/> Yes <input type="checkbox"/> No</td> <td colspan="2"></td> </tr> <tr> <td colspan="5">Other _____</td> </tr> </table>			CLP	Tier I A, B	Tier II A, B	ECRA	RCRA	HSL	PP	Unknowns <input type="checkbox"/> Yes <input type="checkbox"/> No			Other _____				
CLP	Tier I A, B	Tier II A, B	ECRA	RCRA													
HSL	PP	Unknowns <input type="checkbox"/> Yes <input type="checkbox"/> No															
Other _____																	
<p>Date Due To Document Control: _____</p>																	
<p>Comments: _____</p> <p>_____</p> <p>_____</p> <p>_____</p>																	
<p>Received by</p> <p>_____ Metals _____</p> <p>_____ GWQ _____</p> <p>_____ VOA/GC _____</p> <p>_____ VOA/MS _____</p> <p>_____ Prep. _____</p> <p>_____ SEA _____</p>	<p>Surcharge (Please Circle)</p> <p>50% 100% 200%</p> <hr/> <p>Logged by: _____ Date: _____</p> <p>Approved by: _____ Date: _____</p>	<p>Project Information</p> <p>Client Contact: _____</p> <p>Account No.: _____</p> <p>Bill No.: _____</p> <p>Project No.: _____</p> <p>P.O. No.: _____</p> <p>Program: _____</p>															

FIGURE QAPP 7-7 (cont'd)
SAMPLE RECEIVING FORM

Booking Log No.: _____

Enseco - Erco Laboratory

Erco ID	Client ID	Date Sampled	Matrix	Condition	Analyses

Page ____ of ____

sample. Once it is approved by the project manager, the sample receiving form is copied and distributed to the appropriate laboratory managers.

In the event that samples are not properly received, the applicable laboratory's sample custodian will note this on the chain-of-custody, and inform ERCO's project manager. The samples will be rejected, and ERCO's project manager will notify the project manager at ERM verbally and in writing, and necessary corrective action will be taken.

When all the log-in procedures have been completed, the Sample Custodian contacts the appropriate laboratory managers and delivers the samples to a refrigerator where they will be stored under limited access. The designated sample custodians are presented in Section 4.2.7 of this QAPP. Maximum holding times, bottle types and preservatives are specified in Table 6-1.

Each Enseco laboratory maintains an internal laboratory logbook consisting of chronologically ordered sample tracking report sheets. The samples delivered by the sample custodian (or by an analyst in the case of an interlaboratory transfer) will be signed into the internal logbooks prior to storage and or analysis. Examples of sample receipt, tracking, and instrument log sheets are included as Figures 7-8 through 7-18.

Finally, all samples and extracts will be retained after analysis is complete. These samples will only be disposed of upon orders of the Project Manager and only after all tags and identification have been removed for the permanent file.

FIGURE QAPP 7-8

Enseco - Erco Laboratory

B/N/A Sample Transfer Log

Erco ID	Client	Date Holding Time Expires	Sample Type	BNA		Extraction Used	Extraction Data	Surrogate Matrix Spike	Analyst Extr. Date	Associated Blank	Comments	Date Transferred	Re- extraction
				Comb.	Not Comb.								
						Sep. F. ___ Liq/Liq ___ Soxhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	BNA Surr. ___ Acid MS ___ B/N MS ___					
						Sep. F. ___ Liq/Liq ___ Soxhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	BNA Surr. ___ Acid MS ___ B/N MS ___					
						Sep. F. ___ Liq/Liq ___ Soxhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	BNA Surr. ___ Acid MS ___ B/N MS ___					
						Sep. F. ___ Liq/Liq ___ Soxhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	BNA Surr. ___ Acid MS ___ B/N MS ___					
						Sep. F. ___ Liq/Liq ___ Soxhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	BNA Surr. ___ Acid MS ___ B/N MS ___					
						Sep. F. ___ Liq/Liq ___ Soxhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	BNA Surr. ___ Acid MS ___ B/N MS ___					
						Sep. F. ___ Liq/Liq ___ Soxhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	BNA Surr. ___ Acid MS ___ B/N MS ___					
						Sep. F. ___ Liq/Liq ___ Soxhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	BNA Surr. ___ Acid MS ___ B/N MS ___					

QAPP-103

FIGURE QAPP 7-9

Enseco - Erco Laboratory

PESTICIDE SAMPLE TRACKING LOG

Erco ID	Client	Date Holding Time Expires	Sample Type	Analysis	Extraction Used	Extraction Data	Surrogate Matrix Spike	Analyst Extr. Date	Associated Blank	Comments	Date Transferred	Re- extraction
					Sep. F. ___ Liq/Liq ___ Sawhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	DBC ___ Matrix ___ Spike ___					
					Sep. F. ___ Liq/Liq ___ Sawhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	DBC ___ Matrix ___ Spike ___					
					Sep. F. ___ Liq/Liq ___ Sawhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	DBC ___ Matrix ___ Spike ___					
					Sep. F. ___ Liq/Liq ___ Sawhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	DBC ___ Matrix ___ Spike ___					
					Sep. F. ___ Liq/Liq ___ Sawhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	DBC ___ Matrix ___ Spike ___					
					Sep. F. ___ Liq/Liq ___ Sawhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	DBC ___ Matrix ___ Spike ___					
					Sep. F. ___ Liq/Liq ___ Sawhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	DBC ___ Matrix ___ Spike ___					
					Sep. F. ___ Liq/Liq ___ Sawhlet ___ Sonication ___	Vol. Extr. ___ Wt. Extr. ___ % Dryness ___ Conc. by ___	DBC ___ Matrix ___ Spike ___					

QAPP-104

PESTICIDE TRANSFER & ANALYSIS LOG

Gas Chromatograph Log

Detector Type: _____

[illegible]

SEMIVOLATILE GC/MS SAMPLE TRANSFER LOG

SAMPLE TRANSFER LOG

[illegible]

FIGURE QAPP 7-12
SEMIVOLATILE GC/MS INSTRUMENT LOG

ERCO A Division of ENSECO

ANALYSIS LOG

CLIENT	DISK	SAMPLE ID	CONC. or VOL	VOLT. or GAIN	COLUMN	Analyst	DATE	Searched	SDump	Unko	COMMENTS

FIGURE QAPP 7-13

ERCO/A Division of ENSECO Incorporated

VOA SAMPLE RECEIVING AND TRACKING LOG

[illegible]

VOLUME 2: QAPP
SECTION: 7
REV. 4/Feb. 1990

QAPP-108

FIGURE QAPP 7-14

VOA INSTRUMENT LOG

Erco Laboratory

Volatile Organics Laboratory

GC/MS Analysis Log

FRN	Arcv. Tape	Ch. No.	Sample ID	Conc. or Vol.	E.M. Volt	Column		Analyst	Date	Check if Good Run	Comments
						Length	Type				
>											
>											
>											
>											
>											
>											
>											
>											
>											
>											
>											
>											
>											
>											

QAPP-109

VOLUME 2: QAPP
SECTION: 7
REV.4/Feb.1990

FIGURE QAPP 7-16

METALS SOLID SAMPLE RECEIPT LOG

Sample ID	Date Received by Lab	Transferred from	Comments

FIGURE QAPP 7-18
INORGANIC SAMPLE RECEIPT FORM

Analysis

General Location

MATRIX - A = Aqueous
S = Solid
SL = Sludge

[illegible]

7.3 Final Evidence Files

7.3.1 ERM's Final Evidence File

ERM will maintain all original documentation including but not limited to: field chain-of-custody forms, laboratory analytical reports, field notes, sample logs, telecons, photographs, memoranda, logbooks and letters in a designated secure, limited access area at the ERM-Midwest office. All items being placed into this file will be assigned a document control identification number and a document description. All items will then be logged onto the file "Table of Contents." All items added or removed from the file will be signed and dated by the person making the entry. All records will be maintained in this fashion for a period of ten years in accordance with Paragraph XXIII of the Consent Order.

7.3.2 Enseco's Final Evidence File

The final project report, which includes the raw data, is retained in Enseco's laboratory archives. These are permanent, locked archives which are not purged. All associated original logbooks are also retained in these archives.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 Field Instruments

To ensure that measurements during the investigation have been collected with properly calibrated instruments, field personnel will follow the procedures described in the Equipment Owners Manual. All field equipment will be calibrated, at a minimum, twice daily prior to and after use (with the exception of the geophysical instrumentation), maintained, and repaired in accordance with manufacturer's specifications. In addition, prior to use, each major piece of equipment will be cleaned, decontaminated, checked for damages, and repaired as needed. These activities will be noted in a field log notebook.

Despite even the most rigorous maintenance program, equipment failures do occur. When equipment cannot be repaired, it will be returned to the manufacturer for repairs.

Quality control efforts and accuracy and precision objectives for field water quality measurements are summarized below. Calibration procedures and frequency for all field instruments are summarized in Table 8-1. Section 8.1.1 provides detailed calibration procedures for all air and particulate equipment.

8.1.1 Century OVA Meter 128

The OVA 128 is capable of responding to nearly all site specific organic compounds.

QAPP TABLE 8-1

EQUIPMENT MAINTENANCE AND CALIBRATION PROTOCOLS
RUETGERS-NEASE SALEM SITE RI/FS

<u>Equipment</u>	<u>Maintenance/Calibration</u>	<u>Frequency</u>
EM34 and 31 conductivity meters	Internal instrumentation is factory calibrated/ routinely maintained. A background conductivity survey will be performed to calibrate the equipment.	Every 5 yrs. Prior to initiation of the geo-physical survey.
Resistivity meter	Internal instrumentation is factory calibrated/ routinely maintained. A background conductivity survey will be performed to calibrate the equipment.	Every 5 yrs. Prior to initiation of the geo-physical survey.
Seismic	Internal instrumentation is factory calibrated/ routinely maintained.	As Required.
PID photoionization detector	Calibrate with isobutylene gas.	Start and end of each day.
FID flame ionization detector	Calibrate with methane and/or benzene gas.	Start and end of each day.
Explosimeter	Calibrate with methane and carbon monoxide. Zero instrument in air.	Once per month. Start of each day in clean area (e.g., support zone)
pH meters	Calibrate with three pH buffer solutions.	Before and after use, and after every 20 samples

QAPP TABLE 8-1 (cont'd)

EQUIPMENT MAINTENANCE AND CALIBRATION PROTOCOLS
RUETGERS-NEASE SALEM SITE RI/FS

<u>Equipment</u>	<u>Maintenance/Calibration</u>	<u>Frequency</u>
Temperature	Check against a mercury thermometer.	Every 10 samples.
Sp. conductance	Calibrate with one calibration solution.	Before and each use.
Dissolved oxygen meter	Calibration according to manufacturer's recommendations with ambient air.	At the beginning of each day, and every 30 minutes.
Rechargable equipment batteries	Charge	After use as, required.
Sampling accessories (tubing, submersible pumps)	Periodic maintenance performed and recorded in equipment maintenance log.	As required.

The OVA will be calibrated using a mixture of a specific vapor in air, with known concentration. After the instrument is in operation and zeroed by using ambient air that has passed through vapor phase granular activated charcoal, a sample of calibration gas will be drawn into the instrument and calibration will proceed by adjusting the readout to the known concentration. Calibration will be accomplished using a single known sample of methane in air in the range of 90 to 100 ppm. After this calibration, the setting on the "digidial" will be recorded. Calibration on any one range automatically calibrates the other two ranges.

8.1.2 HNU Model P1-101 Photoionization Analyzer

The HNU calibration gas consists of approximately 100 ppm isobutylene in an air matrix. This gas has been referenced to benzene. The calibration gas canister is connected to the HNU inlet probe and the canister is opened. The function switch is then turned to the 0-200 range position (X10). The meter is adjusted to the ppm number on the calibration gas canister. The valve on the calibration gas regulator is disconnected from the probe inlet.

8.1.3 High Volume Particulate Sampling

The calibration of high volume particulate samplers is fairly complicated but is briefly summarized below:

1. A hi-vol sampler will be assembled with a clean filter and operated for at least five minutes at normal line voltage.
2. The rotameter number and date on three gummed labels will be recorded. One label will be affixed to the top of the metal on the front of

the rotameter, another to the middle of the vacuum hose and the third to the side of the hi-vol motor.

3. The rotameter is now attached to the hi-vol motor.
4. The rotameter is adjusted so that the center of the ball reads 60 on the rotameter scale.
 - a. The locking nut is now loosened by turning it from left to right.
 - b. The screw is now adjusted by turning it clockwise to lower the ball and counterclockwise to raise the ball. After this adjustment, the locknut is tightened and the hi-vol motor is turned off.
5. The filter holder is now removed.
6. The calibrated orifice is now attached with one of the load plates between the motor and the orifice.
7. The motor is turned on and the water manometer and rotameter readings are recorded after they stabilize.
8. The motor is turned off.
9. Steps 6-8 are repeated for each load plate.
10. Steps 6-9 are repeated once more.
11. The air flow rate from the hi-vol orifice calibration curve for each manometer reading will be recorded.

12. The barometric pressure in mm of Hg, and the temperature in °C will be recorded.
13. The temperatures measured when the hi-vol orifice was calibrated (T_2) are converted to absolute values (K).
14. The true flow rates corrected to the barometric pressure and temperature are determined by substituting each flow rate for Q_1 in the following equation and by solving for Q_2 .

$$Q_2 = Q_1 \left(\frac{T_2 P_1^{1/2}}{T_1 P_2} \right)$$

where

Q_2 = corrected flow rate, m^3/min ,

Q_1 = flow rate, m^3/min ,

T_2 = absolute temperature (during sampling), K

P_1 = barometric pressure when hi-vol orifice
was calibrated, mm Hg,

T_1 = absolute temperature when hi-vol orifice
was calibrated, K°

P_2 = barometric pressure (during sampling), mm Hg.

The actual flow rate during sampling will be determined by comparing the rotameter with the calibration curve of the rotameter reading vs flow rate. A flow rate of approximately 60 ACFM will be maintained by adjusting the flow controller on the actual hi-volume particulate sampler.

8.1.4 PUF Sampler

The airflow through the sampling system is monitored by a venturi/magnehelic assembly. A multipoint calibration of the venturi/magnehelic assembly must be conducted every six months using an audit calibration orifice, as described in the U.S. EPA High Volume Sampling Method (Section 8.1.3). A single point calibration must be performed before and after each sample collection, using the procedure described below.

Prior to calibration a "dummy" PUF cartridge and filter are placed in the sampling head and the sampling motor is activated. The flow control valve is fully opened and the voltage aviator is adjusted so that a sample flow rate corresponding to approximately 110% of the desired flow rate is indicated on the magnehelic. The motor is allowed to warmup for approximately 10 minutes and then the flow control valve is adjusted to achieve the desired flow rate. The ambient temperature and barometric pressure will be recorded. The calibration orifice is then placed on the sampling head and a manometer attached to the tap on the calibration orifice. The sampler is momentarily turned off to set the zero level of the manometer. The sampler is then switched on and the manometer reading recorded, once a stable reading is achieved. Calibration is now complete. The calibration curve for the orifice is then used to calculate sample flow using the just obtained manometer reading.

The calibration curve for the venturi/magnehelic assembly is used to calculate sample flow from the manometer measurement. The calibration data will be recorded. If the manometer and venturi/magnehelic values do not agree within 10%, the sampler will be inspected for damage, flow blockage, etc. If no obvious problems are found the sampler will be recalibrated (multi-point) according to the U.S. EPA High

Volume Sampling procedure. If the values agree within 10%, calibration will proceed as follows:

1. Calibration of the PUF Sampler is performed without a foam slug or filter paper in the sampling module. However, the empty glass cartridge will remain in the module to insure a good seal through the module.
2. The GMW-40 Calibrator is installed on top of the 4" filter hole.
3. An 8" water manometer is connected to the Calibrator.
4. The ball valve is fully opened.
5. The system is turned on by tripping the manual switch on the timer.
6. The voltage control screw is adjusted to obtain a reading of 70 inches on the dial gage (magnehelic gage).
7. With 70 inches on the dial gage as the first calibration point, the manometer reading will be recorded.
8. The ball valve is slightly closed to readjust the dial gage down to 60 inches. The manometer reading will be recorded.
9. Using the above procedure, the ball valve will be adjusted for dial gage readings at 50, 40, and 30 inches and recorded.

10. Using these two sets of readings, a curve will be plotted. This curve will be used for determining the actual flow rate in the field.
11. The voltage control is then readjusted fully clockwise to its maximum setting.

8.1.5 Pump Flow Rate Calibration for the Tenax, XAD-2 and CMS Traps

A mass flow meter will be utilized to measure and control the flow rate through each sampling train. A wet test meter will be utilized to verify the flow through each mass flow meter. A pump, mass flow meter, and mass controller will be connected in series. The system will operate for a fixed period of time. Each revolution of the dial on the wet test meter represents the displacement of a known volume of water by air. By knowing the volume of air passing through the system per unit of time, the mass flow meter will be calibrated. An initial calibration will be performed upon each mass flow meter. The mass flow meters will be recalibrated weekly or whenever abnormalities become apparent.

8.2 Enseco Analytical Instrumentation

Enseco will employ analytical methods found in the U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis (Rev. 8/87) and Inorganic Analysis (Rev. 8/87) EPA CLP (SOW). These methods cite the appropriate calibration and check procedures that are required to conduct the analyses properly. An outline of these procedures follows:

8.2.1 GC/MS -- Volatiles (VOA)

The instrument is hardware tuned using 50 ng Bromofluoro benzene (BFB). Ion Abundance criteria must meet that of EPA CLP. Initial calibration is required at 20, 50, 100, 150, and 200 ug/L. Average Response Factors (RF) and Relative Standard Deviations (RSD) are calculated for each compound (see Table 9-2 in Section 9.1.1 for Target Compound List [TCL]). Calibration check compounds (CCC) are: 1,1-dichloroethene, chloroform, 1,2-dichloropropane, toluene, ethylbenzene, and vinyl chloride. System Performance Check Compounds (SPCC) are chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2- tetrachloroethane, and chlorobenzene. For the initial calibration to be considered valid, the relative percent difference (RSD) must be less than or equal to 30.0 percent for CCC's. The RF for SPCC's must be 0.300 or greater; 0.250 or greater for bromoform. Analysis of samples can proceed for twelve hours following the time of the BFB injection once these criteria are met. Continuing calibration is achieved through 50 ng BFB injection and criteria, and a calibration standard containing all of the TCL compounds. For a continuing calibration to be valid, SPCCs must meet the same criteria as that for the curve, and CCCs RF's less than or equal to 25.0% difference from those of the curve. Sample analysis can proceed for twelve hours from the time of the BFB injection once these criteria are met.

8.2.2 GC/MS -- Semivolatiles and Diphenyl Sulfone and Dichloronitrobenzene

Semivolatiles calibration procedures follow the same analytical calibration scheme as that of volatiles with the following differences: DFTPP is used to meet ion abundance criteria. The initial calibration is required at 20, 50, 80, 120, and 160 ng/ul. Nine compounds contained on the TCL list

are not required in the 20 ng/ul standard. There are 13 CCC's and 4 SPCC's which are listed in the method. The minimum acceptable RF for SPCC's is 0.050. The maximum % RSD for the CCC's in the initial calibration is 30.0%. The percent difference required for continuing calibrations is 25.0%. Procedures for preparing calibration standards, their concentrations, and internal standards which will be used to quantitate DPS and 3,4 DCNB have been provided in the final method validation study.

8.2.3 GC/MS -- Mirex, Kepone and Photomirex

The specific procedures for preparing calibration standards and their concentrations, the levels for matrix spikes and surrogates, and recovery standards have been presented in the final method validation study. Calibration procedures are also provided in this document.

8.2.4 GC -- Pesticides/PCBs

Calibration is initially established for each GC and column used. Three concentrations of evaluation standards are run containing aldrin, endrin, dibutylchlorendate and 4-4'-DDT. Calibration factors (CF) and %RSDs are calculated for each compound. %RSD must be less than 10.0% for quantitation. The total breakdown of Endrin and 4-4'-DDT is calculated and must be less than 20.0%. An initial calibration is then run containing each of the single and multi-component pesticides. This establishes initial calibration. Continuing calibration standards are run every five samples and at the end of the 72 hour period. Percent differences must not exceed 15.0% for quantitation or 20.0% for confirmation. A confirmation analysis is run to confirm any compound tentatively identified in the primary analysis. Quantitation can be done using the secondary analysis.

Criteria for a second column confirmation and the 72 hour sequence are found in the EPA CLP method.

8.2.5 Metals

8.2.5.1 Inductively Coupled Plasma (ICP)

A five point multi-element calibration curve is run to establish initial calibration. An initial calibration verification (ICV) is then run. All elements in the ICV must agree with the true values to $\pm 10\%$. An interference check standard (ICS) is then run and elements must agree with the true values to $\pm 20\%$. Sample analysis can then proceed. A continuing calibration verification (CCV) is run after every 10 samples and all elements must be within $\pm 10\%$ of the true value. Sample analysis can continue for up to 8 hours or until the CCV is out, at which point the instrument must be recalibrated.

8.2.5.2 Graphite Furnace AA

The same analytical scheme as that for ICP is used. A five point calibration is run and verified with an ICV which must fall within $\pm 10\%$ of the true value. A CCV is run every 10 samples and must agree to $\pm 10\%$. Additionally, samples are double-burned and the RPD must be 20% or less.

8.2.5.3 Cold Vapor AA-Mercury

A four point initial calibration is used. The resulting correlation coefficient derived from the calibration curve must be greater than or equal to 0.995. An ICV is then run and must be within $\pm 15\%$ of the true value. A CCV is run every 10 samples and must agree with the true value $\pm 15\%$.

8.2.5.4 Cyanide - Distillation

A five point initial calibration is used. The resulting correlation coefficient derived from this calibration curve must be greater than or equal to 0.995. An ICV is then run and must be within $\pm 15\%$ of the true value. A CCV is run every 10 samples and must agree with the true value within $\pm 15\%$.

8.2.6 Standards

Enseco's primary sources of standard reference materials for calibrations and calibration checks are the U.S. EPA and National Bureau of Standards repositories. Secondary sources are reliable commercial supply houses, such as Supelco, Aldrich, and Chem Service. Specific projects, such as pesticide certification programs, may require the use of client-specified reference standards. New standards are routinely checked against known standards, traceable to EPA or NBS reference materials, if available. Each of Enseco's laboratories maintains a Standards Preparation Logbook in which all pertinent information regarding the source and preparation of each analytical standard is recorded. Examples are shown in Figures 8-1 and 8-2.

Reagents used in the preparation of matrix spike and matrix spike duplicate solutions and in surrogate standard spiking solutions are obtained directly from the U.S. EPA or are validated using EPA-traceable standards. Quality Control Check Samples are requested and received on a frequent basis from EPA-EMSL in Cincinnati.

Reagents that are used in large quantities are analyzed for purity at Enseco's laboratories prior to purchase, according to lot number.

FIGURE QAPP 8-1
STANDARDS LOG SHEET

[illegible]

FIGURE QAPP 8-2

STANDARDS LOG SHEET

[illegible]

QAPP-129

VOLUME 2: QAPP
SECTION: 8
REV.4/Feb.1990

8.2.7 Instrumentation

Enseco instrumentation includes:

8.2.7.1 GC/MS/DS Systems -- Semivolatile Organics

- o Finnigan MAT 4600/Super INCOS GC/LC/MS/DS
- o Finnigan MAT 4500/Super INCOS GC/MS/DS
- o Finnigan MAT 4521/INCOS GC/MS/DS
- o Hewlett Packard 7970B magnetic tape unit
- o Cipher magnetic tape unit

8.2.7.2 GC/MS/DS Systems -- Volatile Organics

- o Three Hewlett Packard 5996 GC/MS systems with HP RTE-6 Data Systems and Tekmar LSC-2 purge and traps with Tekmar ALS automatic samplers
- o Hewlett Packard 5985 GC/MS/DS with HP RTE-6 Data Systems and Tekmar LSC-2 purge and traps with Tekmar ALS automatic samplers
- o Nutech #8533 thermal desorption unit

8.2.7.3 GC Systems -- Semivolatile Organics

- o Three Hewlett Packard 5890A GCs with dual electrol capture detectors and HP 7673A autosamplers
- o Hewlett Packard 5890A with single flame ionization detector and single nitrogen photometric detector and HP 7673A autosampler

- Hewlett Packard 5880A with single flame ionization detector and HP 7671A autosampler
- Hewlett Packard 5880A with dual electron capture detectors and flame-photometric detector and HP 7673A autosampler
- Hewlett Packard 5880A with dual electron capture detectors and HP 7671A autosampler
- Hewlett Packard 5840A with single flame ionization detector and HP 7672A autosampler
- Hewlett Packard 5840A with single flame ionization detector and HP 7671A autosampler
- Hewlett Packard 5840A with single electron capture detector and HP 7671A autosampler
- Hewlett Packard 5840A with single electron capture detector and single flame ionization detector and HP 7671A autosampler
- Hewlett Packard 5840A with single electron capture detector and HP 7671A autosampler
- Hewlett Packard 5840A with single electron capture detector and single flame ionization detector and HP 7671A autosampler

8.2.7.4 Other Chromatographic Instrumentation

- Waters HPLC with WISP automated sample processor and UV (variable wavelength), fluorescence, and refractive index detectors

- Farrand Mark I Spectrofluorometer with corrected excitation and emission
- ABC 1002 gel permeation chromatograph for preparative cleanup of sludges and fatty tissues

8.2.7.5 Spectrophotometric Instrumentation

- Perkin-Elmer 710B infrared spectrophotometer

8.2.7.6 Inorganic Instrumentation -- Metals

- Jarrell-Ash 9000 Inductively Coupled Argon Plasma Emission Spectrometer with 33 analytical channels, background correction capability, and Apple software and graphics
- Jarrell-Ash 970 Inductively Coupled Argon Plasma Emission Spectrometer with 40 fixed and 1 variable wavelength analytical channels, dual discs, and background correction capability
- Three Perkin-Elmer 3030 Zeeman Atomic Absorption Spectrophotometers with HGA-600 graphite furnaces, AS-60 automatic samplers, and HGA graphics software
- Perkin-Elmer 5100 Zeeman Atomic Absorption Spectrophotometer with deuterium background correction, HGA-600 graphite furnace, AS-60 automatic sampler, and HGA graphics software
- Perkin-Elmer 3030B Atomic Absorption spectrophotometer with deuterium background correction and graphics software
- Perkin-Elmer 603 Atomic Absorption Spectrophotometer with graphic, digital, and computer-compatible output;

deuterium background correction; electrode discharge lamps; and Hg, As, Sb, and Se accessories

- o Two Millipore Super Q ultrapure water systems
- o Two Fisher Mercury Analyzers

8.2.7.7 Inorganic Instrumentation -- Wet Chemistry

- o AlpKem RFA-300 Rapid Flow Analyzer
- o Two Technicon AutoAnalyzers - 1 channel
- o Dohrmann DC80 TOC Analyzer
- o Mitsubishi Model MCI 10 TOX Analyzer
- o Labconco Rapid Digestor 25

8.2.7.8 Analytical Balances

- o Metler PE600
- o Metler H51
- o Metler PN1210
- o Cahn 25 Electrobalance
- o Cahn TA450
- o Ohaus B1500D
- o Sartorius 2462
- o Metler PM4600

9.0 ANALYTICAL PROCEDURES

In order to accomplish the objectives of the RI/FS, analysis for Volatile Organics, Semivolatile Organics, Dioxins and Furans, Inorganics, and various non-target compounds (mirex, photomirex, kepone, dichloronitrobenzene, and diphenyl sulfone) will be performed. All standard TCL analyses will be performed using the most recent revision of the U.S. EPA's Statement of Work for Organics, Inorganics and Dioxins/Furans (U.S. EPA PCDF/PCDD protocol, exhibit D, analytical methods, draft April 19, 1989 and revised in November, 1989 and EPA CLP SOW 8/87). Enseco currently holds contracts with the U.S. EPA for each of these categories. The following sections provide analytical references and method descriptions for each of the parameters in the different matrices.

The non-target compounds are also discussed in this section with detailed descriptions of the methods developed for this particular program. A method validation study will be performed on each of the non-standard components and will determine method detection limits, precision, and accuracy.

9.1 Sample Preparation

9.1.1 TCL Analyses: Volatiles, Semivolatiles, Pesticides, PCBs, Metals, Dioxins and Furans

Waters and soils will be prepared according to EPA CLP guidelines. These can be found in the following publications: Organics; U.S. EPA Contract Laboratory Program Statement of Work for Organic Analyses (Rev. 8/87); Inorganics: U.S. EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, SOW No. 787, (Rev 12/87); Dioxins and Furans; U.S. EPA PCDF/PCDD protocol, exhibit D, analytical methods, draft April 19, 1989 and revised in November, 1989 and EPA CLP SOW 8/87.

ERM-Midwest, inc.

For semivolatile, organics this method involves solvent extraction of the water sample using a separatory funnel and Kuderna-Danish (KD) concentration. Soil samples are sonicated and concentrated to 1 ml. using KD concentrations. For soils with high level non-TCL interferences, GPC cleanup will be employed, if needed.

Pesticides and PCBs in water are solvent extracted, concentrated, and subject to alumina column cleanup. Soil samples are sonicated and concentrated, and cleaned up on an alumina column.

For dioxins and furans in soil and sediments, samples are extracted with methanol/petroleum ether, solvent-exchanged into hexane, and subjected to multiple cleanup procedures. Water samples are extracted with methylene chloride, solvent-exchanged into hexane, and washed with aqueous potassium hydroxide, sodium chloride, and sulfuric acid to remove gross interferences. Dioxin and furan analysis will be performed at Enseco-California Analytical Laboratory using U.S. EPA PCDF/PCDD protocol, exhibit D, analytical methods, draft April 19, 1989 and revised in November, 1989 and CLP-SOW 8/87. California Analytical currently performs these analyses under SAS contracts with the U.S. EPA.

Volatile organics in water and low-level soils require no preparation step other than using appropriate dilution volumes and adding surrogate and internal standard compounds prior to analysis. Medium level soils are methanol extracted, injected into water, and purged.

Inorganics in water and soil are acid digested prior to analysis.

For all preparations, Enseco Laboratory will strictly adhere to the EPA CLP protocol. Target Compound Lists and Method Detection Limits for each analysis are listed in Tables 9-1 through 9-6.

Table 9-1

Target Compound List and Detection Limits
for Semivolatile Organics

Parameter	Detection Limits ^a		
	Water (µg/L)	Selected Water (µg/L)	Soil ^{b,c} (µg/kg)
Phenol	10	2	330
bis(2-Chloroethyl)ether	10	1.5	330
2-Chlorophenol	10	1.5	330
1,3-Dichlorobenzene	10	1.5	330
1,4-Dichlorobenzene	10	1.5	330
Benzyl alcohol	10	2	330
1,2-Dichlorobenzene	10	2.5	330
2-Methylphenol	10	1	330
bis(2-Chloroisopropyl)ether	10	2.5	330
4-Methylphenol	10	1	330
N-nitroso-di-n-dipropylamine	10	1.5	330
Hexachloroethane	10	2	330
Nitrobenzene	10	2.5	330
Isophorone	10	2.5	330
2-Nitrophenol	10	2	330
2,4-Dimethylphenol	10	2	330
Benzoic acid	50	25	1,600
bis(2-Chloroethoxy) methane	10	2.5	330
2,4-Dichlorophenol	10	2	330
1,2,4-Trichlorobenzene	10	2	330
Naphthalene	10	2	330
4-Chloroaniline	10	3.3	330
Hexachlorobutadiene	10	2.5	330
4-Chloro-3-methylphenol (para-chloro-meta-cresol)	10	1.5	330
2-Methylnaphthalene	10	2	330
Hexachlorocyclopentadiene	10	2	330
2,4,6-Trichlorophenol	10	4.7	330
2,4,5-Trichlorophenol	50	1.5	1,600
2-Chloronaphthalene	10	1.5	330
2-Nitroaniline	50	10	1,600
Dimethylphthalate	10	1.5	330
Acenaphthylene	10	1.5	330
2,6-Dinitrotoluene	10	1	330
3-Nitroaniline	50	12.2	1,600
Acenaphthene	10	1.5	330
2,4-Dinitrophenol	50	23	1,600
4-Nitrophenol	50	15	1,600
Dibenzofuran	10	1	330

See next page for footnote references.

Table 9-1 (Continued)

Target Compound List and Detection Limits
for Semivolatile Organics

Parameter	Detection Limits ^a		
	Water (µg/L)	Selected Water (µg/L)	Soil ^b (µg/kg)
2,4-Dinitrotoluene	10	1	330
Diethylphthalate	10	1	330
4-Chlorophenyl-phenyl ether	10	1.6	330
Fluorene	10	1	330
4-Nitroaniline	50	20	1,600
4,6-Dinitro-2-methylphenol	50	15	1,600
N-nitrosodiphenylamine ^d	10	1.5	330
4-Bromophenyl-phenylether	10	1.5	330
Hexachlorobenzene	10	1.5	330
Pentachlorophenol	50	2	1,600
Phenanthrene	10	1	330
Anthracene	10	2.5	330
Di-n-butylphthalate	10	2	330
Fluoranthene	10	1.5	330
Pyrene	10	1.5	330
Butylbenzylphthalate	10	3.5	330
3,3'-Dichlorobenzidine	20		660
Benzo(a)anthracene	10	1.5	330
Chrysene	10	1.5	330
bis(2-Ethylhexyl)phthalate	10	1	330
Di-n-octylphthalate	10	1	330
Benzo(b)fluoranthene	10	1.5	330
Benzo(k)fluoranthene	10	1.5	330
Benzo(a)pyrene	10	2	330
Indeno(1,2,3-cd)pyrene	10	3.5	330
Dibenz(a,h)anthracene	10	2.5	330
Benzo(g,h,i)perylene	10	4	330
Diphenyl sulfone	10	4	1000
Dichloronitrobenzene	25	12	1700

^aSpecific quantitation limits are highly matrix dependent. The quantification limits are provided for guidance and may not always be achievable.

^bQuantitation limits listed for soil are based on wet weight. The quantitation limits calculated by the laboratory for soil (calculated on a dry weight basis) will be somewhat higher.

^cDetection limits for medium level soil samples are 60 times the low level detection limits.

^dReported as diphenylamine.

Table 9-2

**Target Compound List and Detection Limits
for Volatile Organics**

Parameter	Detection Limits ^a		
	Water (µg/L)	Selected Water (µg/L)	Soil ^{b,c} (µg/kg)
Chloromethane	10	1.5	10
Bromomethane	10	1.5	10
Vinyl chloride	10	1.5	10
Chloroethane	10	1.5	10
Methylene chloride	5	1	5
Acetone	10	5	10
Carbon disulfide	5	3	5
1,1-Dichloroethene	5	1.5	5
1,1-Dichloroethane	5	1.5	5
1,2-Dichloroethene (total)	5	1.5	5
Chloroform	5	1.5	5
1,2-Dichloroethane	5	1.5	5
2-Butanone	10	5	10
1,1,1-Trichloroethane	5	1.5	5
Carbon tetrachloride	5	1.5	5
Vinyl acetate	10	5	10
Bromodichloromethane	5	1.5	5
1,2-Dichloropropane	5	1.5	5
cis-1,3-Dichloropropene	5	1	5
Trichloroethene	5	1.5	5
Dibromochloromethane	5	1.5	5
1,1,2-Trichloroethane	5	1.5	5
Benzene	5	1.5	5
trans-1,3-Dichloropropene	5	2	5
Bromoform	5	1.5	5
4-Methyl-2-pentanone	10	3	10
2-Hexanone	10	5	10
Tetrachloroethene	5	1.5	5
Toluene	5	1.5	5
1,1,2,2-Tetrachloroethane	5	1.5	5
Chlorobenzene	5	1.5	5
Ethyl benzene	5	1.5	5
Styrene	5	1	5
Total xylenes	5	2	5

^aSpecific quantitation limits are highly matrix dependent. The quantification limits are provided for guidance and may not always be achievable.

^bQuantitation limits listed for soil are based on wet weight. The quantitation limits calculated by the laboratory for soil (calculated on a dry weight basis) will be somewhat higher.

^cDetection limits for medium level soil samples are 125 times the low level detection limits.

Table 9-3

Target Compound List and Detection Limits
for Pesticides/PCBs

Parameter	Detection Limits ^a		
	Water (µg/L)	Selected Water (µg/L)	Soil ^{b,c} (µg/kg)
alpha-BHC	0.05	0.010	8.0
beta-BHC	0.05	0.005	8.0
delta-BHC	0.05	0.005	8.0
gamma-BHC (Lindane)	0.05	0.005	8.0
Heptachlor	0.05	0.030	8.0
Aldrin	0.05	0.005	8.0
Heptachlor epoxide	0.05	0.005	8.0
Endosulfan I	0.05	0.010	8.0
Dieldrin	0.10	0.010	16.0
4,4'-DDE	0.10	0.005	16.0
Endrin	0.10	0.010	16.0
Endosulfan II	0.10	0.010	16.0
4,4'-DDD	0.10	0.020	16.0
Endosulfan sulfate	0.10	0.10	16.0
4,4'-DDT	0.10	0.020	16.0
Methoxychlor	0.5	0.005	80.0
Endrin ketone	0.10	0.030	16.0
alpha-Chlordane	0.5	0.020	80.0
gamma-Chlordane	0.5	0.020	80.0
Toxaphene	1.0	0.25	160.0
Aroclor-1016	0.5	0.10	80.0
Aroclor-1221	0.5	0.10	80.0
Aroclor-1232	0.5	0.10	80.0
Aroclor-1242	0.5	0.10	80.0
Aroclor-1248	0.5	0.10	80.0
Aroclor-1254	1.0	0.10	160.0
Aroclor-1260	1.0	0.10	160.0

^aSpecific quantitation limits are highly matrix dependent. The quantification limits are provided for guidance and may not always be achievable.

^bQuantitation limits listed for soil are based on wet weight. The quantitation limits calculated by the laboratory for soil (calculated on a dry weight basis) will be somewhat higher.

^cDetection limits for medium level soil samples are 15 times the low level detection limits.

Table 9-4
Target Compound List and Detection Limits
for Inorganics

Parameter	Detection Limits ^a	
	Water (µg/L)	Soil ^b (mg/kg)
Aluminum	200	40
Antimony	60	12
Arsenic	10	2
Barium	200	40
Beryllium	5	1
Cadmium	5	1
Calcium	5,000	1,000
Chromium	10	2
Cobalt	50	10
Copper	25	5
Cyanide	10	2
Iron	100	20
Lead	5	1
Magnesium	5,000	1,000
Manganese	15	3
Mercury	0.2	0.04
Nickel	40	8
Potassium	5,000	1,000
Selenium	5	1
Silver	10	2
Sodium	5,000	1,000
Thallium	10	2
Vanadium	50	10
Zinc	20	4

^aSpecific quantitation limits are highly matrix dependent. The quantification limits are provided for guidance and may not always be achievable.

^bQuantitation limits listed for soil are based on wet weight. The quantitation limits calculated by the laboratory for soil (calculated on a dry weight basis) will be somewhat higher.

Table 9-5

**Target Compound List and Detection Limits
for Polychlorinated
Dibenzofurans and Dibenzo-p-dioxins**

Parameter	Detection Limits ^a	
	Water (ng/L)	Soil ^b (µg/kg)
Tetra (total)	1	0.1
Penta	1	0.5
Hexa	1	0.5
Hepta	5	1.0
Octa	10	5.0

^aSpecific quantitation limits are highly matrix dependent. The quantification limits are provided for guidance and may not always be achievable.

^bQuantitation limits listed for soil are based on wet weight. The quantitation limits calculated by the laboratory for soil (calculated on a dry weight basis) will be somewhat higher.

TABLE 9-6

Target Compound List and Detection Limits for
Mirex, Photomirex, and Kepone

Parameter	Detection Limits ^{ab}			
	Water ($\mu\text{g/L}$)	Soil ^c ($\mu\text{g/kg}$)	Fish ($\mu\text{g/kg}$)	Air ^d ($\mu\text{g/m}^3$)
Mirex	0.003	9	13	0.0334
Photomirex	0.024	10	8	0.0522
Kepone	0.066	34	97	0.544

^aSpecific quantitation limits are highly matrix dependent. The quantitation limits are provided for guidance and may not always be achievable.

^bPractical quantitation limits, which are two times the method detection limits, will be used for reporting purposes.

^cQuantitation limits listed for soil are based on wet weight. The quantitation limits calculated by the laboratory for soil (calculated on a dry weight basis) will be somewhat higher.

^dDetection limits for these compounds in air are based on the assumption of one cubic meter of air collected.

9.2 Instrument Start-Up Performance Check

All instruments will be calibrated according to the EPA CLP methods. This involves mass spectrometer performance and sensitivity checks, and multilevel calibrations, with tabulations of %RSD, average responsibility factors, and %D. For a detailed description of Instrument Calibration see Section 8.

Bromofluorobenzene (BFB) is used to tune the GC/MS for volatile organics and decafluorotriphenylphosphine (DFTPP) for semivolatile organics. Tunes are established every 12 hours and standard and/or sample analysis cannot proceed unless EPA CLP criteria is met. Tabulations of tunes and the associated raw data is included in the final project report.

9.3 Establishment of Detection Limits for Parameters

Detection Limits for all organic and inorganic TCL parameters in soil and water are listed in Tables 9-1 through 9-5. Enseco Laboratory anticipates achievement of these detection limits; however, highly contaminated samples may have somewhat higher quantitation limits based upon the best available technology. All efforts will be made to achieve the lowest possible detection limits on all samples, including highly contaminated samples. Various cleanup procedures, such as alumina column cleanup and gel permeation chromatography, will be employed if needed.

Enseco Laboratory expects to meet all of the QC criteria, including sensitivity, precision, accuracy, and completeness as listed in Section 5.0. If outliers exist, reanalyses will be performed and documented as per the EPA CLP protocol. The case narrative will note any of these occurrences.

9.4 Initial and Continuing Calibrations

The EPA CLP criteria for initial and continuing calibrations will be strictly followed. This criteria includes multilevel calibrations for organic and inorganic analytes. Sample analysis cannot proceed until this specific criteria is met.

Specific calibration procedures for each of the TCL analyses is contained in Section 8.0. A standards package, including tabulation reports of response factors, %RSD and %D, will be provided in addition to the raw data.

9.5 Analytical Procedures for Each Sample Matrix and Parameter

Enseco's SOP for the analysis for TCL VOA, BNA and pesticide/PCB analytes in fish and the SOP for achieving low-level detection limits in drinking water for TCL VOA, BNA, pesticide/PCB analytes are presented as Attachments 1 and 2, respectively, of this QAPP. The SOP for the analysis of DPS and DCNB will be provided with the final method validation study.

9.5.1 Volatile Organics in Water and Soil

Analyses are conducted using the purge-and-trap GC/MS procedure in accordance with EPA CLP methods. All procedures, including purge-and-trap, tuning, calibration of the GC/MS system, quantitation, quality control, and reporting protocols, are in strict adherence with the August 1987 revision of the EPA's CLP protocols. A target compound list and detection limits for all volatile compounds are listed in Table 9-2. This table also contains low-level

detection lists requested on selected water samples. The methods that the laboratory will use to achieve these detection limits are covered in Section 9-7.

9.5.2 Semivolatile Organics in Water and Soil

The extraction and analysis procedures are conducted in accordance with the EPA CLP protocol. All procedures, including extraction, tuning calibration of the GC/MS system, quantitation, quality control, and reporting protocols, are in strict adherence with the August revision of the EPA's CLP protocols. Detection limits for semivolatiles in water and soil are listed in Table 9-1. This table also contains low-level detection lists requested on selected water samples. The methods that the laboratory will use to achieve these detection limits are covered in Section 9-7.

9.5.3 Pesticides/PCBs in Water and Soil

The analyses of organochlorine pesticides and polychlorinated biphenyls are conducted in accordance with EPA CLP methods.

The extract is run on a GC/ECD using a packed column. The analyte is quantitated on a GC/ECD after a second column confirmation. All procedures, including extraction, analysis, quantitation, quality control, and reporting protocols, are in strict adherence with the August 1987 revision of the EPA's CLP protocols. Detection limits for pesticides and PCBs in water and soil are listed in Table 9-3.

9.5.4 Polychlorinated Dibenzo-Dioxins and Polychlorinated Dibenzofurans in Water and Soils

Analyses of polychlorinated dibenzo-dioxins and polychlorinated dibenzofurans will be performed by Enseco at California Analytical Laboratory using U.S. EPA PCDF/PCDD protocol, exhibit D, analytical methods, draft April 19, 1989 and revised in November 1989. This procedure uses a matrix-specific extraction, an analyte-specific cleanup, and a high resolution capillary column GC/low resolution mass spectrometry. If interferences are encountered, the method defines several cleanup procedures to minimize the interference.

If tetrachlorodioxins are found, the extract will be analyzed for 2,3,7,8-TCDD by EPA CLP SOW 8/87. Subsequent column cleanup procedures are utilized as needed. Detection limits for polychlorinated dibenzo-dioxins and polychlorinated dibenzofurans in water and soil are listed in Table 9-5.

9.5.5 Inorganics in Water and Soil

To determine the metal content of a sample, Enseco uses either atomic absorption spectroscopy or inductively-coupled plasma (ICP). Acid digestion and analytical procedures are in strict adherence with the December 1987 revision of the EPA's CLP protocols. Detection limits for inorganics in water and soil are listed in Table 9-4.

9.5.6 Cyanides in Water and Soils

Analysis of cyanides will be performed using the December 1987 revision of the EPA CLP protocols. Detection limits are listed in Table 9-4.

9.6 Chain-of-Custody

Chain-of-custody in the laboratory starts with the Sample Custodian, who receives the samples, coordinates them with chain-of-custody records, logs the samples into the computerized tracking system, and assigns a unique Enseco identification number to them. A booking log form is filled out with documents Enseco Sample ID number, Client ID, date sampled and test request. An internal case number will be assigned. This case number will correspond to all samples received within one sampling week. Matrix spikes, matrix spike duplicates, duplicates, and blanks will be assigned upon log-in.

Once the project assignment is completed and approved by the project manager, the samples are delivered to the appropriate labs, where the personnel sign and date the internal chain-of-custody forms. If there is no preparation step required, the analysis proceeds, and unused portions of the sample are stored. If there is a preparation step involved, the resulting extract is transferred to the appropriate analytical laboratory and an extract transfer logbook is filled out, signed, and dated to document internal extract chain-of-custody.

Additional information on sample custody and chain-of-custody is provided in Section 7.

9.7 Analytical Procedures for Non-CLP Parameters

9.7.1 Mirex, Photomirex and Kepone in Water and Soil

The analytical procedure for mirex, photomirex, and kepone utilizes GC/MS with the Pulsed Positive Negative Ion Chemical Ionization (PPNICI) detection system. The

extraction and analysis procedures were developed at Enseco to achieve low level detection limits in the various matrices. These methods have been validated at Enseco. The following is a detailed description of preparation, analysis and quality control procedures for these compounds. Detection limits are listed in Table 9-6.

9.7.2 Sample Preparation for Mirex, Photomirex and Kepone in Water

The following extraction procedure will be followed when analyzing for mirex, photomirex, and kepone in water.

1. Add 1,000 ml of sample to a separatory funnel.
2. Add approximately 0.5 ml concentrated HCL.
3. Add 100 ng of ^{13}C -mirex.
4. Add 60 ml methylene chloride and shake for 2 minutes.
5. Allow the layers to separate for 10 minutes.
6. Drain the methylene chloride layer into an Erlenmeyer flask.
7. Repeat steps 4-6 two more times.
8. After the third extraction, pour the combined extract into a KD flask through a funnel containing anhydrous sodium sulfate. Rinse the sodium sulfate with an additional 50 ml methylene chloride.
9. Add 200 ul toluene to each flask.

10. Add a boiling chip to each flask and insert a Snyder condenser column into the flask. Concentrate the extract to a volume of 5 ml in a water bath at 85-90°C.
11. Replace the macro Snyder column with a micro Snyder column and concentrate further to 1 ml.
12. Remove the KD apparatus and blowdown the extract to 200 ul under a stream of nitrogen.
13. Add 5 ul of isopropanol to the 200 ul extract.

9.7.3 Sample Preparation for Mirex, Photomirex and Kepone in Soil

The following extraction procedure will be followed when analyzing for kepone, mirex, and photomirex in soil.

1. Decant and discard any water layer.
2. Add 30 g of homogenized soil to an acid-cleaned Teflon jar with 60 g anhydrous sodium sulfate and mix well.
3. Add 1000 ng of ^{13}C -mirex.
4. Add 100 ml of methylene chloride/acetone (a 70:30 mixture).
5. Agitate on an automatic shaker for 30 minutes.
6. Centrifuge for 3 minutes.

7. Decant liquid into an Erlenmeyer flask.
8. Repeat steps 4-7 two more times.
9. Quantitatively transfer combined extracts through sodium sulfate into KD apparatus. Wash the remaining soil/sodium sulfate mixture with 60 ml methylene chloride/acetone and transfer liquid into KD apparatus also.
10. Add 1 ml toluene.
11. Add a boiling chip to each flask and insert a Snyder condenser column into the flask. Concentrate the methylene chloride/acetone extract to a volume of 5 ml in a water bath at 85-90°C.
12. Replace the macro Snyder column with a micro Snyder column and concentrate further to 1 ml.
13. Remove the KD apparatus and blowdown the extract to 1 ml under a stream of nitrogen.
14. Add 25 ul of isopropanol to the 1 ml extract.

9.7.4 Analysis for Mirex, Photomirex and Kepone

9.7.4.1 GC/MS Operating Conditions

Column: J&W DB-5, 0.32 mm ID, 30 m

Initial Temp: 30°C

Initial Time: 4 min

Ramp Rate: 10°C/min

Final Temp: 290°C

Final Time: 10 min

Injection Volume: 2 ul water, air matrices
1 ul solid, fish matrices

Injection Port Temp: 240°C

Injector: Grob-type, splitless

Carrier Gas: Helium

Reagent Gas: Methane

A mass spectrometer utilizing the pulsed positive negative ion chemical ionization (PPNICI) detection system is used. The ion ranges that will be monitored for mirex, photomirex, and kepone are presented in Table 9-7.

9.7.4.2 Calibration Procedure

Initially, the GC/MS system is calibrated with a five-level calibration curve containing the following compounds: mirex, photomirex, and kepone. Calibration factors will be generated from this curve. The %RSD for mirex and photomirex must be less than 30%. For kepone it must be less than 40%. The calibration curve will establish a 12 hour window in which samples can be run. The levels of the calibration standards will be specified in the final method validation plan.

A daily continuing calibration check will be run subsequent to the initial calibration. The daily calibration will consist of the three target compounds at a mid-

TABLE 9-7

Major Ions in the Monitored Clusters for
Mirex, Photomirex, Kepone and ^{13}C -Mirex.

Analyte	Quantitation Ions (First Cluster)	Confirmation Ions (Second Cluster)	Confirmation Ions (Third Cluster)
Mirex	368, 370	402, 404	437, 439
Photomirex	368, 370	402, 404	437, 439
Kepone	383, 385	418, 420	-
<u>Internal Standard</u>			
$^{13}\text{C}_8$ -Mirex	376, 378	410, 412	445, 447

concentration range: Response factors for mirex and photomirex must be within 30% for the daily calibration standard to be used. The daily calibration will initiate a 12-hour analytical time period in which samples can be run. Calibration curves will be rerun if the daily calibration does not meet the preceding criteria.

9.7.4.3 Sample Analysis and Quantitation

Samples will be quantitated using an isotope dilution internal standard quantitation procedure. The total integrated ion current of the mass ranges will be used for quantitation unless it is found there are interferences present. In this case, one selected ion current will be used for quantitation.

Detection limits for mirex, photomirex and kepone are listed in Table 9-6. The levels of the matrix spikes and recovery standards, along with the recovery acceptance criteria, are based on the results of the method validation study and are listed in Table 5-2. Full details on the analysis of mirex, photomirex and kepone are presented in Sections 9.7.1 through 9.7.4.2 of this QAPP and in Section 4 of the Method Validation Study.

9.7.4.4 Reporting Format

All raw data, including standards packages, chromatograms, extracted ion current profiles (EICPs), quantitation reports, and spectra will be provided in the final report. Tabulations of standards and recoveries will also be provided.

9.7.4.5 Quality Control Procedures

One method blank will be extracted with every 20 samples or every time samples are set up, whichever is more frequent. Holding times are listed in Section 6. A matrix spike and matrix spike duplicate, containing each of the three

compounds, will be extracted with every set of 20 samples, or with every case, whichever is more frequent. The recovery percent and difference relative percent will be calculated. Control limits will be set at ± 3 SD of the mean recovery value derived from the method validation study.

9.7.5 Analysis of Diphenyl sulfone (DPS) and Dichloronitrobenzene (DCNB) in Water and Soil

The diphenyl sulfone (DPS) and dichloronitrobenzene (DCNB) will be analyzed as part of the semivolatile analysis. The GC/MS system will be calibrated for all of the compounds indicated in the August 1987 EPA contract. In addition to this, a five-point calibration will be run for DPS and DCNB, and average response factors will be generated. These compounds will also be run on a daily basis as a continuing calibration standard. The quantitation ion mass for DPS will be m/z 125 and for DCNB m/z 145. Quantitation, identification, and reporting protocols are in strict adherence with the August 1987 revision of the EPA's CLP protocols. Detection limits for DPS and DCNB in water and soil are listed in Table 9-1. Full details on the analysis of DPS and DCNB are presented in Section 9.7.5.1 through 9.7.5.4 of this QAPP and in Section 3 of the Method Validation Study.

9.7.5.1 Sample Preparation for DPS and DCNB

DPS and DCNB will be extracted out of water and soil along with the other semivolatile organics. Therefore, a separate extraction for the two compounds will not be done. The EPA CLP semivolatiles extraction procedure will be followed (EPA CLP SOW 8/87).

9.7.5.2 Analysis of DPS and DCNB

DPS and DCNB will be analyzed for in the semivolatile GC/MS fraction. GC conditions and MS scan ranges in the EPA

CLP method will detect the presence of either of the compounds.

9.7.5.3 Calibration Procedures

An initial five-point calibration will be run for DPS and DCNB at 20-160 ppb. The %RSD for the compounds must be less than 30%. A daily continuing calibration will be run. For the continuing calibration standard, %D for the two compounds must be less than 30%. The same analytical procedure (i.e. DFTPP tune requirements 12 hour analytical time window) will be followed as that for the EPA CLP semivolatiles.

9.7.5.4 Quality Control Procedures

One method blank will be extracted with every 20 samples or every time samples are set up, whichever is more frequent. Holding times are listed in Table 6-1. DPS and DCNB will be added to the semivolatiles matrix spike. Control limits derived from the method validation study are listed in Table 5-2.

9.7.6 Fish Tissue Analysis

Preparative extraction and cleanup procedures used by Enseco for analysis of fish tissue can be found in "Interim Methods for the Sampling and Analysis of Priority Pollutants in Sediments and Fish Tissue," EPA 600/4-81-055 (Revised October 1980). Holding times are listed in Section 6. A brief method description of each of these procedures will follow. Any modifications to the above referenced procedures would be in the area of aliquot size, which is dictated by the size of the sample available.

Detection limits that can be expected for the various analyses in fish tissue are approximately the same as those for soil but may be somewhat higher due to sample size and matrix interferences. Results will be reported on a wet weight basis.

Once sample extracts have been generated through the above referenced methods, EPA CLP methods will be used to analyze the extracts. Therefore for fish analysis, refer to the appropriate soil analysis for method descriptions. The only deviation from the EPA CLP methods will be control limits.

9.7.6.1 Semivolatiles, Pesticides, PCBs, Mirex, Photomirex, and Kepone in Fish Tissue

For the larger upper trophic level fish, the laboratory will fillet the fish prior to analysis. In the case of all lower trophic level fish and smaller upper trophic level fish, the laboratory will use the entire fish as the sample. The frozen tissue or fish is first homogenized in a Tissuemizer. Four aliquots of this fish are taken, using a 30 gm sample size for each aliquot of semivolatiles, and a 5 gm sample aliquot for volatiles. For semivolatiles, pesticides, and PCBs the aliquot is mixed with sodium sulfate and soxhlet extracted using a methylene chloride/methanol mixture. The semivolatiles and pesticide/PCB aliquots are spiked, prior to extraction, with EPA CLP surrogate mixtures. The extracts are then washed with an acidic sodium sulfate saturated water solution, and the acidic water is reextracted and the resulting extract is combined with the initial extract. The extract is then concentrated and subjected to GPC cleanup prior to analysis.

9.7.6.2 Volatile Organics in Fish Tissue

The homogenized tissue will be directly purged in water. EPA CLP internal and surrogate standards will be used to monitor purging efficiency and recovery. Instrument tuning, calibration, and quantitation procedures will be EPA CLP methods for volatile organics in soil. It should be noted that some fish tissue absorbs internal and surrogate standards, therefore purging efficiency and recoveries could be affected.

9.7.6.3 Quality Control Procedures

One method blank will be extracted with every 20 samples or every time samples are set up, whichever is more frequent. A matrix spike and matrix spike duplicate will be performed for every 20 samples. The five non-TCL extractable compounds will be added to the matrix spike. Surrogate spikes will be added according to CLP protocol. The control limits are listed in Tables 5-2 and 5-3.

9.7.7 Low-Level Detection Limits for Selected Water Samples

Detection Limits on selected water samples are listed in Tables 9-1 through 9-6. The following methods will be used to achieve these detection limits.

9.7.7.1 Semivolatiles and DPS, DCNB

To achieve the detection limits requested for the selected water samples, only minor adjustments to the EPA CLP method will be made. Most compounds on the TCL list are detected at the levels referenced in the Selected Water Column in Table 9-1 using the CLP method. To decrease the detection limits, the extracts will be concentrated to a final volume of 0.5 ml, which will yield of a four time sensitivity increase over the standard EPA CLP method, which calls for a final volume of 2.0 ml.

EPA CLP surrogate and matrix spikes will be used at 50% concentration.

All other procedures including tuning, calibration, quantitation, QC, and documentation will be according to EPA CLP methods.

9.7.7.2 Pesticides/PCBs

To achieve the detection limits on selected water for pesticides/ PCBs, the EPA CLP method will be employed.

Detection limits for this method, listed in Table 9-3, can be achieved using standard CLP methods.

9.7.7.3 Volatile Organics

EPA Method 524.2 will be used to achieve the detection limits listed in Table 9-2. Method 524.2 can be found in "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water", U.S. EPA, September 1986.

EPA CLP calibration, quantitation, QC, and reporting protocols will be followed. All raw data will be provided in the final report.

9.7.7.4 Mirex, Photomirex and Kepone

The extraction and PPNICI GC/MS procedure outlined in Section 9.7.1 was developed to achieve the detection limits listed in Table 9-1 for Selected Water Samples.

9.7.8 Air Analysis

9.7.8.1 Semivolatiles, DPS and DCNB

The samples will be taken in XAD-2 tubes. The tubes will be desorped as follows:

1. Break the tube. Empty the material into methylene chloride rinsed Vortex test tubes. Do not empty the glass wool into the Vortex tube. A blank tube will be provided.
2. Spike with 1 ml of BNA surrogate.
3. If the tube provided is for a matrix spike/matrix spike duplicate, spike with 10 ml of a 10 ng/ul solution of EPA CLP matrix spike solution before breaking the tube.

4. Add 8-9 mls of methylene chloride.
5. Mix on the Vortex 1-2 minutes.
6. Decant the methylene chloride into a methylene chloride rinsed 40 ml Teflon screw top vial.
7. Repeat steps 4-6 two more times.
8. The final extracts volume will be concentrated to 1 ml.

For analysis, EPA CLP tuning, calibration, and quantitation procedures will be followed. EPA CLP Quality Control will be followed, including a method blank with every set of samples extracted, and a matrix spike/matrix spike duplicate with every set of 20 samples or every case, whichever is more frequent. Control limits for surrogate and matrix spike recoveries are presented in Table 5-2. All raw data will be provided in the final report.

9.7.8.2 Organochlorine Pesticides/PCBs

EPA Method T04 will be used for the Organochlorine pesticides/PCB analysis in air. This method involved soxhlet extraction of a glass fiber filter with a polyurethane foam absorbent cartridge. The extraction solvent is 5% diethylether in hexane, and the extraction time is 14-24 hours.

The resulting extract is concentrated to 10 mls, and a 5 ml portion is taken for the pesticide/PCB analysis. This portion is concentrated to 1 ml and analyzed in accordance with EPA CLP protocols.

The other portion of the extract will be analyzed for mirex, photomirex, and kepone. Because of possible interferences in the negative CI spectrum, DBC will not be spiked into the samples.

EPA CLP QC will be followed, including a method blank, and a matrix spike/matrix spike duplicate per every 20 samples. (EPA method TO4 is contained in Compendium Methods for Determination of Toxic Organic Compounds in Ambient Air, EPA 600/4-84-040.) Control limits are presented in Table 5-2.

9.7.8.3 Volatile Organics

EPA Methods TO1 and TO2 will be used for VOA priority pollutant analysis in air. Method TO1 involves thermal desorption of the Tenax cartridge directly onto a cold trap. The organic compounds are then transferred onto the front of a GC column and analyzed by GC/MS. (EPA Methods TO1 and TO2 are contained in Compendium Methods for Determination of Toxic Organic Compounds in Ambient Air, EPA 600/4-84-040).

Method TO2 involves thermal desorption of Carbon Molecular Sieve Tubes onto a trap.

The TO1 and TO2 thermal desorption analyses for the volatile organic compounds will be performed at the Enseco-CRL/El Monte Air Toxics Laboratory. Calibration protocols from EPA Methods TO1 and TO2 will be followed. Reporting protocols and deliverables will be EPA CLP.

Presently, there is no technically acceptable method for preparing and analyzing matrix spikes utilizing these methods, thus matrix spike analysis will not be done. Method blank analysis will be performed with every set of samples taken, or every 20 samples, whichever is more frequent.

9.7.8.4 Mirex, Photomirex and Kepone

A portion of the extract from the Organochlorine pesticides/PCB air sample will be analyzed for mirex, photomirex, and kepone. The extract will be concentrated to 200 ul and analyzed according to Section 9.7.1.

Control limits will be established based on the results of the method validation study and are listed in Table 5-2.

9.7.9 Physical Parameters

GZA will perform the analysis of the physical parameters on the specified soil borings. The methods that will be utilized for each parameter are as follows:

<u>Parameter</u>	<u>Method</u>
Moisture	ASTM*-D-2216
Soil Classification	ASTM*-D-2487
Atterburg Limits	ASTM*-D-4318
Specific Gravity	ASTM*-D-854
Permeability	US Army Corp EM1110-2-1906
Grain Size	ASTM*-422
Porosity	Calculated by density, specific gravity and unit weight

*ASTM - American Society of Testing and Materials

10.0 DATA REDUCTION, VALIDATION AND REPORTING

10.1 ERM's Data Reduction, Validation and Reporting

Data validation practices will be followed to insure that raw data are not altered and that an audit trail is developed for those data which require reduction. All the field data, such as those generated during field measurements, observations and field instrument calibrations, will be entered directly into a bound field notebook. Each project team member will be responsible for proofing all data transfers made, and the Field Operations Manager will proof at least 10 percent of all data transfers.

Upon receipt of the sample data packages, the laboratory data will be quantitatively and qualitatively validated by ERM's Project QA/QC Manager. The data will subsequently be submitted to Region 5 of the U.S. EPA. Data validation is discussed in detail in Section 14.

It is anticipated that ERM's data reduction for this investigation will be minimal and will consist primarily of tabulating analytical results from Enseco's Form 1s (Analytical Reports) onto summary tables through the use of computerized spreadsheet software. All reduced data will be assigned document control identification numbers and placed in the final evidence file maintained by the Project Manager.

All analytical data obtained during the course of the investigation for ground waters, surface waters, seeps and leachates will be reported as ug/l (organics and inorganics). Solid sample results will be reported as ug/kg (organics) and mg/kg (inorganics) on a dry weight basis. Dioxin/furan, mirex, kepone and photomirex will be reported in parts-per-billion (ppb). Data packages associated with the analyses of samples collected during the RI will be prepared utilizing full CLP deliverables. The required deliverables are stated in Section B of EPA CLP SOW 8/87 for RAS organic, dioxin and inorganic IFB.

10.2 Laboratory Reduction, Validation and Reporting

10.2.1 Data Reduction

Raw data obtained from instrument readouts, chromatograms, strip chart recorders, and physical measurements are reduced to concentrations of analytes by use of the appropriate equations given in each of the methods referenced in Section 9.

10.2.2 Data Validation

Data validation is the process of reviewing data and accepting or rejecting it on the basis of sound criteria. The data generated receive both technical and editorial review. Technical review concerns itself with the analytical techniques and their effect on data validity. Editorial review ensures that the text is concise and lucid and that it contains no transpositional errors. Enseco scientists use appropriate validation methods and criteria to validate data. The criteria used in evaluating data include:

- o Accuracy requirements
- o Precision requirements
- o Detection limit requirements
- o Completeness
- o Representativeness

For research and methods development-type parameters, the acceptable warning and control limits may be statistically defined as analytical results become available. Routine analytical procedures for which windows have not been established are subject to an acceptance limit of ± 3 SD (three standard deviations).

10.2.3 Data Reporting

Complete data packages inclusive of all raw data, will be submitted for each of the analyses. The data reporting protocols can be found in the EPA CLP methods. These data packages will include bar graphs and listings from BFB and DFTPP tones, raw data from standards including %RSD and %Difference tabulations, raw data from samples and blank runs, including mass spectra, and summary sheets with surrogate recoveries, matrix spike recoveries, and method blank data.

Qualifiers used when reporting data are found in the EPA CLP contract. Sample results will not be blank corrected. Case narratives will be provided which document any non-standard occurrences within the case. Any and all non-standard occurrences will be relayed to the project manager at ERM and the Project QA/QC Manager. They will then be responsible for notifying the appropriate personnel and implementing project level corrective action, such as resampling.

A "Case" will be considered one sample delivery group (samples received at the laboratory during a seven day period). Non-CLP parameters will be reported in the following manner. Dichloronitrobenzene and diphenyl sulfone will be added to the semivolatiles target compound list and reported in the semivolatiles sections. Mirex, photomirex, and kepone will be reported in a separate report section and subsections of this report will include all raw data, including standard chromatograms, EICPs, quantitation reports, associated sample and standard spectra, summary sheets of sample results for all samples, blanks and matrix spikes. Sample results will not be blank corrected. Qualifiers used will be those found in the EPA CLP contract.

The key individuals from Enseco, who will handle data reporting, are the following laboratory senior personnel:

Volatiles, W. Henry Camp, Charlene Livingston; Semivolatiles, DPS, DCNB, Peter Kane, Linda Cook; Pesticides and PCBs, Ellie Kwong, Mary Ellen Fitzpatrick; Mirex, Photomirex, and Kepone, Agnes Van Langenhove, Peter Kane; Inorganics, Susan Chapnick, Vaughn Pusey; Dioxins/Furans, William Lukjemburg, Steven Rodgers; and Air Methods T01 and T02, Steven Harris.

11.0 INTERNAL QUALITY CONTROL

11.1 Field Quality Control Checks

Field Quality Control Checks will be utilized during this investigation through the use of the following:

- o Trip Blank -- One trip blank will be submitted for each cooler of aqueous samples for the analysis of volatile organics. One trip blank in 20 solids/biota will be submitted for volatile analysis. Trip blanks will be prepared by the laboratory with deionized water, preserved with HCL, transported to the site, handled like a sample, and returned to the laboratory for analysis. Trip blanks for air samples will consist of sealed Tenax and CMS cartridges transported to the site and returned unopened to the laboratory for analysis. One trip blank will be submitted for 6 investigation samples. Trip blanks are not opened until they are received by the laboratory for analysis.
- o Field Blanks -- Field blanks are prepared in the field to ensure a sampling device (e.g., bailer or pump) has been effectively cleaned. The sampling device is filled with deionized water or deionized water is pumped through the device, transferred to the appropriate sample bottles, preserved and returned to the laboratory for analysis. Field blanks for solid matrix are prepared by pouring deionized water through the solid sampling equipment directly into appropriate solids bottleware and one will be submitted for every 20 solid samples collected. Field blanks for air analysis will be prepared by opening each

canister/cartridge on-site and allowing any ambient contaminants to passively diffuse onto the collection media. The field blank will be collected at an upwind location. One field blank will be submitted for the air samples. One field blank will be collected for every 20 groundwater samples. The one per 20 samples for field blanks for groundwater samples apply since dedicated sampling equipment will be utilized for the collection of samples from each monitoring well. One field blank will be collected for every 10 surface water samples or everyday of sampling (whichever is more frequent).

- o Field Duplicates or Replicates -- Two sets of samples from a single sample location are obtained (replicates) or prepared (duplicates), labeled with unique sample numbers, and submitted to the laboratory to determine analytical precision and sample representativeness. Field duplicates/replicates will be collected at a frequency of 1 per 10 samples per matrix.
- o Performance Evaluation (PE) -- Samples submitted for dioxin/furan analysis will be accompanied by known concentration PE samples. These PE samples will be supplied by the U.S. EPA. The acceptable concentrations (within 95% CI) will be requested of the U.S. EPA after data arrives at ERM since this information is necessary to assess analytical accuracy. One PE sample will be submitted with each batch of samples for dioxin/furan analysis.
- o Matrix Spike/Matrix Duplicate Samples -- Matrix Spike (MS) and Matrix Spike Duplicate (MSD) samples will be submitted as further QC checks. One MS and MSD in every twenty (20) ground water, surface water, soil, sediment and fish samples will be collected and submitted for organic

analysis. These will allow accuracy to be determined by the recovery rates of compounds (the matrix spike and/or surrogate spike compounds defined in the analytical methods). The purpose of these laboratory spikes is to monitor any possible matrix effects specific to samples collected from the site. The addition of known concentrations of compounds/constituents into the sample also monitors extraction/digestion efficiency.

The analysis of MS and MSD samples checks precision by comparison with the respective spiked recoveries. In addition, any non-spiked analytes present in an unspiked sample will be compared with the results of the non-spiked compounds in the MS and MSD. Therefore data will be assessed for precision for this triplicate analysis. The analysis of laboratory duplicates (inorganics) is an excellent assessment of analytical precision.

Duplicate/replicate and matrix spike sample aliquots will be acquired for ground water, surface waters, and fish by collecting sequential grab samples after the collecting of the initial sample aliquot. Therefore, the specific sample location which will be used for matrix spikes and duplicates/replicates will be chosen by the Field Operations Manager. Multiple air samples will be collected simultaneously at a given sample location for replicate samples. Soil duplicate or replicate and matrix spike samples will be collected by splitting the sample between the sample container, duplicate container, and matrix spike container. Homogenizing will not be performed for the aliquots designated for volatile organic compounds; therefore, they are designated as sample replicates. If insufficient soil sample is present at a particular location to collect the three sample volumes, a single sample bottle will be split at the laboratory for MS and MSD analysis.

11.2 Laboratory Quality Control Checks

All QC procedures employed at Enseco Laboratory are, at a minimum, equivalent to those described in the EPA CLP methods (referenced in Section 9). Each individual Enseco Laboratory maintains its own internal QC program as summarized below. The various control limits for continuing calibration checks for analysis of mirex, kepone, photomirex, DPS and DCNB will be specified in the final method validation study.

11.2.1 Trace Organic Analysis: Volatiles, Semivolatiles, Pesticides and PCBs, Dioxins, Mirex, Photomirex, and Kepone

General QC protocols for trace organic analyses include:

- o Field blanks, when applicable, to detect contamination introduced during sampling, shipping and handling.
- o A minimum of one procedural blank (method blank) in every 20 samples analyzed to detect contamination during analysis.
- o One matrix spike and one matrix spike duplicate per every 20 samples, or per case, whichever is more frequent; to determine recovery, precision, and the presence of matrix effect.
- o Surrogate standards and internal standards to quantitate results, determine recoveries and to account for sample-to-sample variation.
- o Routine analysis of performance evaluation samples and blind spikes to document method accuracy.
- o Multilevel initial calibrations of instruments to establish calibration curves.

- o Continuing calibration standards at least once every 12 hours of instrumental analysis for accurate quantitation, and recalibration if these do not meet EPA CLP criteria.
- o Calibration of GCs and GC/MSs according to the appropriate EPA CLP methods.
- o Tuning of GC/MS systems every 12 hours to meet EPA criteria using BFB (bromofluorobenzene) for volatile organics analysis, and DFTPP (decafluoro-triphenylphosphine) for semivolatile analysis, as described in Section 8.0.

11.2.2 Trace Metals Analysis

General QC protocols for trace metals analyses include:

- o Analysis of moderate-to-high concentration levels by ICP (inductively coupled plasma spectroscopy) or flame atomic absorption spectroscopy.
- o Analysis of low-level metal concentrations by graphite furnace atomic absorption spectroscopy.
- o Calibration blanks and method blanks prior to and between the analysis of samples.
- o Multilevel calibration curves generated by analyses of individual standards (AA) or mixed standards (ICP).
- o Initial calibration verification (ICV) and Continuing Calibration Verification (CCV) at a minimum of one every ten samples to verify instrument calibration.
- o ICP Interference Check Standards after initial calibration and after samples are analyzed.

- o Recalibration and reanalysis of applicable samples if check standard response deviates by more than 10% (15% for mercury) from the initial calibration
- o A minimum of one matrix spike in every 20 samples or one for each sample matrix type
- o A minimum of one duplicate in every 20 samples analyzed.
- o A minimum of one Laboratory Control Spike for every 20 samples analyzed.
- o A minimum of one method blank for every 20 samples.
- o Digestion of solid or sludge samples according to EPA procedures.

11.2.3 Control Limits

Control limits used will be those defined by the EPA-CLP methodology. For fish tissue and air samples, the control limits listed in Tables 5-2 and 5-3 will be used.

For the five non-routine analytes, control limits will be established from the method validation data. The control limits will be ± 3 SD from the mean. These will be presented in the final method validation study.

12.0 PERFORMANCE AND SYSTEM AUDITS

12.1 External Audit of Laboratory by U.S. EPA Region 5

Enseco participates in a wide variety of certifications, programs, and contracts, it is subjected to rigorous external audits by many government regulatory agencies and industrial clients. Tables 12-1 and 12-2 provide lists of such audits. EPA Quarterly Blind Performance Evaluation Studies are also performed; recent results of these studies are given in Table 12-3.

Enseco presently holds EPA CLP contracts for Organics and Inorganics, and is audited on a regular basis by the U.S. EPA under these contracts. Quarterly performance evaluations are also performed under each of these contracts. For this project, Enseco, CAL Analytical, and CRL/El Monte are available for an audit by U.S. EPA Region 5 Central Regional Laboratory (CRL).

12.2 Laboratory Internal Audits

Each laboratory is subjected to quarterly systems audits by Enseco's QA Director as well as by an external team consisting of the Corporate Vice President of QA and the QA Directors of the other Enseco laboratories. These audits are intended to serve two purposes: 1) to ensure that laboratories are complying with the procedures defined in laboratory manuals and contracts, and 2) to determine any sample flow or analytical problems. The frequency of the audits will be increased if problems are encountered. Figure 12-1 outlines the general form a laboratory audit takes and the items that may be covered.

Internal performance audits are also conducted on a quarterly basis. The Vice President of QA submits a spiked sample to each laboratory as a routine sample and reviews the data after the analyses are completed. This is one of

Table 12-1
Erco systems audits, January 1987 to December 1987

Auditor	Date
1) California Department of Health	Feb. 26, 1987
2) Massachusetts DEQE	March 19, 1987
3) Anthony S. Wong, Vice President Quality Assurance and Safety Enseco Incorporated	March 30, 1987
4) New York Department of Health	April 6 & 7, 1987
5) Geraghty & Miller, Inc.	April 13, 1987
6) Anthony S. Wong, Vice President Quality Assurance and Safety Enseco Incorporated	April 20 & 21, 1987
7) Florida Department of Health and Rehabilitative Services	May 4, 1987
8) Woodward-Clyde Consultants (volatile data)	May 29, 1987
9) Dr. Joseph O'Brien Certification Officer Massachusetts DEQE	June 11, 1987
10) Dr. Anthony S. Wong, Vice President Quality Assurance and Safety Enseco Incorporated	July 21-24, 1987
11) Edwin Perkins, Clive Morrick NYS DEC, Department of Law	August 4, 1987
12) Browning-Ferris, Inc. (BFI)	August 13, 1987
13) U.S. EPA Teklaw, Lockheed Inorganic CLP audit	August 31, 1987
14) Julia Wilcox Enseco Incorporated Laboratory Walkthrough	October 5, 1987
15) Edward Maser Commonwealth of Pennsylvania	November 6, 1987
16) Martin Marietta Army Corps of Engineers	December 16, 1987

Table 12-2

Erco performance evaluations, January 1987 to December 1987

Agency/Program	Parameter(s)	Date
1) ERA Quarterly	VOA, metals, inorganics, semi-volatile organics, PCBs, pesticides	Feb. 13, 1987
2) U.S. EPA - New CLP Contract Preaward	Semivolatile organics, VOA, PCBs, pesticides	Feb. 14, 1987
3) NYS DOH Nonpotable Water	VOA, metals, pesticides, inorganics, semi-volatile organics, PCBs	March 15, 1987
4) U.S. EPA VOA Preaward	VOA	Feb. 17, 1987
5) U.S. EPA NEIC QB-2, FY-87 Case No. 6666	Semivolatile organics, VOA, PCBs, pesticides	Feb. 20, 1987
6) OSW Study IX	Semivolatile organics, (pesticides), metals	Feb. 23, 1987
7) NJ Check (WS-18)	Fluoride, endrin, methoxychlor, lindane	Feb. 18, 1987
8) U.S. EPA Water Pollution Study WP-018	VOA, metals, inorganics, pesticides, PCBs	Apr. 5, 1987
9) U.S. EPA Water Supply Study WP-020	VOA, metals, inorganics, pesticides, herbicides	May 18, 1987
10) NY DOH Potable Water Study (Drinking Water)	Trihalomethanes, metals, pesticides, herbicides,	May 26, 1987
11) U.S. EPA-OSW Study X	Semivolatile organics, (PAH) metals	May 18, 1987
12) Enseco Blind Sample Check	Semivolatile organics, VOA, metals, inorganics, PCBs, pesticides	May 8, 1987
13) ARCO	Petroleum hydrocarbons/ biomarkers	June 1, 1987

Table 12-2 (Continued)

Erco Performance Evaluations, January 1987 to December 1987

Agency/Program	Parameter(s)	Date
14) U.S. EPA NEIC QB-3, FY-87, Case No. 7144	VOA, semivolatile organics, pesticides, PCBs	May 28, 1987
15) New York Nonpotable Water	Semivolatile organics, VOA, inorganics, metals, PCBs, pesticides	Aug. 17, 1987
16) Enseco Quarterly PE (3rd Quarter)	Semivolatile organics, VOA, inorganics, metals, pesticides, PCBs	Aug. 24, 1987
17) U.S. EPA-OWS Study XI	Semivolatile organics, EP Tox metals	Aug. 24, 1987
18) U.S. EPA-CLP QB-4, FY87	Semivolatile organics, VOA, pesticides	Sept. 24, 1987
19) U.S. EPA Water Pollution Study WP-019	VOA, pesticides, PCBs, metals, inorganics	Sept. 28, 1987
20) Army Corps of Engineers		Oct. 26, 1987
21) NY DOH Potable Water Study (Drinking Water)	Trihalomethanes, metals, pesticides, herbicides, inorganics	Nov. 2, 1987
22) Enseco Quarterly PE (4rd Quarter)	Semivolatile organics, VOA, inorganics, metals, pesticides, PCBs	Nov. 11, 1987
23) U.S. EPA Water Supply Study WS-021	VOA, metals, inorganics, pesticides, herbicides	Nov. 16, 1987
24) U.S. EPA OSW	Semivolatile organics, EP Tox metals	Dec. 7, 1987

Table 12-3

EPA Quarterly Blind Performance Evaluation Studies

EPA ID	Date	Raw Score (%)
1) QB4, FY-84, Case #3061	Nov. 1984	82
2) QB1, FY-85, Case #3287	Feb. 1985	77
3) QB2, FY-85, Case #3821	May 1985	96
4) QB3, FY-85, Case #4183	Aug. 1985	90
5) QB4, FY-85, Case #4604	Dec. 1985	93
6) QB1, FY-86, Case #5076	March 1986	100
7) QB2, FY-86, Case #5423	May 1986	99
8) QB3, FY-86, Case #5772	Aug. 1986	94
9) QB4, FY-86, Case #6076	Nov. 1986	83.7
10) QB1, FY-87, Case #6437	Jan. 1987	96
11) QB2, FY-87, Case #6666	May 1987	96
12) QB3, FY-87, Case #7144	July 1987	100
13) QB4, FY-87, Case #7760	Dec. 1987	97

Figure QAPP 12-1
ENSECO-ERCO Audit Outline

Laboratory Audit - General Considerations

Sample Flow through Lab

Chain of Custody

Usual

Strict

Sample Storage

Controlled Access

Proximity to Chemical Storage

Physical Conditions, e.g., Temperature

Holding Times

Sample Work-up and/or Analysis

SOPs

Logbooks

Standards Preparation

Instrument - Sample Analysis

Calibration/Tune

Standards Analyses

Check Samples

Balance

Temperature

Notebooks

Dates

Signature

Filled Pages

Initialed Errors with Single-line Crossouts

Units Recorded

QC Samples

Blanks

Spikes

Duplicates

Surrogates

Control Charts

Data File Storage

Hard Copies

Other Media - Magnetic Tape, Disk

Laboratory Safety

Organization, Order

Sampling

Container Preparation

Preservative(s)

Techniques

QA Access - Corrective Action Forms

the most valuable techniques for evaluating the quality of the entire analytical system, including personnel, instrumentation, methodology, and analytical procedures. Both the frequency and the number of spiked samples will be increased if problems are encountered or when the workload increases.

12.3 On-Site Field Audit Procedures

An on-site system audit will be performed monthly during major field activities to review all field-related quality assurance activities. The system audit will be conducted by the Project QA/QC Manager. Figure 12-2 presents ERM's Quality Assurance Audit forms. Deficiencies found during the audits will be brought to the attention of the responsible individuals and corrective action as per Section 15 of this QAPP will be initiated. Copies of the audits will be distributed to all appropriate project personnel.

Specific elements of the on-site audit include the verification of:

- o Completeness and accuracy of sample Chain-of-Custody forms, including documentation of times, dates, transaction descriptions, and signatures.
- o Completeness and accuracy of sample identification labels, including notation of time, date, location, type of sample, person collecting sample, preservation method used, and type of testing required.
- o Completeness and accuracy of field notebooks, including documentation of times, dates, drillers' names, sampling method used, sampling locations, number of samples taken, name of person collecting samples, types of samples, results of field

FIGURE QAPP 12-2

ERM QUALITY ASSURANCE AUDIT

PROJECT _____ W.O.# _____

DATE _____ AUDIT CONDUCTED FROM _____ HR. TO _____ HR.

AUDITOR(S): _____

ON-SITE SAMPLING PERSONNEL: _____

Audit Conducted on the Following:

_____ Soil Sampling	_____ Decontamination
_____ Surface Water/Sediment	_____ Health & Safety
_____ Ground Water	

Sample Collection:

Do sampling locations agree with those specified
in the Work Plan? _____

Is the sampling locating either documented
sufficiently or marked to allow it to be
found/sampled again in the future? _____

Are sampling times, ERM Traffic Report Numbers and
sample description noted? _____

Is sampling proceeding from the suspected least
contaminated area to the most contaminated area? _____

Have sample bottles been labeled properly? _____

Have proper containers and preservatives been used? _____

Are proper sample volumes procured? _____

Are samples being refrigerated/iced immediately
after collection? _____

Does a travel blank exist for each matrix present? _____

Does the potential for sample cross-contamination
exist based on procedures observed? _____

FIGURE QAPP 12-2 (cont'd)

Soil Sampling (Check if not applicable _____):

Type: _____ Hand _____ Auger or Rig

Are samples being collected at proper depths? _____

Are samples being screened with an OVA (if specified in Work Plan and applicable)? _____

Is a description of soils/materials being logged? _____

(Have soils been homogenized where applicable (specified by the Sampling Plan)? _____

Surface Water/Sediment Sampling (Check if not applicable _____):

Have stream flow and velocity parameters been noted?
Estimated _____ or Measured _____

Has sampling proceeded from downstream to upstream locations? _____

Has the sampler acquired the water sample upstream of his position to minimize suspended sediment from entering the sample? _____

Have water samples been collected in the mixing zone, not stagnant areas? _____

Have sediments been characterized as to type and size distribution? _____

Has the proper sediment fraction (fine, depth) been sampled for the analyses of interest? _____

Are the selected locations effectively monitoring effects of the potential source? _____

Ground Water Sampling (Check if not applicable _____):

Have the well specifications been noted properly (i.e., Total Depth, Casing diameter, Depth-to-water to the nearest one-hundredth of a foot, etc.)? _____

Has the purge volume been calculated properly? _____

What evacuation method has been used?
_____ Bailer _____ Submersible _____ Bladder Pump
_____ Other (_____)

If metals are being analyzed, have the samples been field filtered? _____

Are field pH, conductivity, and temperature being measured? _____ Is there documentation of calibrating the instruments? _____

Has well yield been properly evaluated to determine when sample acquisition should take place (i.e., well goes dry and needs to recover). _____

Is bailer line and bailer dedicated to each well and line disposed of after use? _____

Bailer type _____ Line type _____

Have appropriate measures been taken to dispose of contaminated purge water, pump lines, bailers, etc? _____

For Domestic Wells - Has as much information on the well and distribution system been obtained, i.e., depth, casing type, diameter, treatment present, etc.? _____

Has the sample been collected prior to treatment and as close to the well head as possible? _____

Has the domestic well been purged sufficiently to reach temperature stabilization? _____

Have the weather conditions been recorded? _____

Decontamination:

Has sampling equipment been decontaminated properly for the given analytes? _____

Have the proper decontamination solutions been used? _____

For large equipment (backhoes, drill rigs), has decontamination taken place in an appropriate area? _____

Has decontaminated water/solution been collected for proper disposal? _____ Where disposed? _____

Safety:

Is the proper level of protective clothing being worn for the tasks? _____ Level A ____ B ____ C ____ D ____

Is the site Health and Safety Plan present with proper emergency contacts included? _____

Is monitoring equipment present? _____ OVA _____
H₂, O₂ meter _____ Explosimeter _____ Other _____

General:

Audit Summary and Comments:

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

Signed by: _____ Print: _____

Date: _____

measurements, soil logs, and any problems encountered during sampling.

- o Adherence to health and safety guidelines outlined in the Site Health and Safety Plan including wearing of proper protective clothing.
- o Adherence to decontamination procedures outlined in Section 6 of this QAPP, including proper decontamination of pumps and pump tubing, bailers, and sampling equipment.
- o Adherence to sample collection, preparation, preservation, and storage procedures.

13.0 PREVENTATIVE MAINTENANCE

13.1 Field Equipment Maintenance

ERM's field equipment is maintained through the use of a tracking system incorporating the tagging of each equipment item. This tag identifies its most recent maintenance, battery charge, and condition. When damaged or equipment in need of repair is returned to the equipment warehouse, it is appropriately flagged for the required maintenance to be performed. This process assures only operable and maintained equipment enters the field. Routine daily maintenance procedures conducted in the field will include:

- o Removal of surface dirt and debris from exposed surfaces of the sampling equipment and measurement systems.
- o Cleansing of filters in the organic vapor analyzer.
- o Storage of equipment away from the elements.
- o Daily inspections of sampling equipment and measurement systems for possible problems (e.g., cracked or clogged lines or tubing or weak batteries).
- o Check instrument calibrations as described in Section 8.0 of this QAPP.
- o Charging any battery packs for equipment when not in use.

Spare and replacement parts stored in the field to minimize downtime include, but are not limited to the following:

- o Appropriately sized batteries
- o Locks
- o Extra sample containers and preservatives
- o Bailer line
- o Additional bailers
- o OVA igniters and filters
- o Calibration gases, battery charger, and support equipment
- o Spare filters for filtration apparatus.
- o Extra pH probes, conductivity probes, samples coolers, packing material, and sample location stakes.
- o Additional supply of health and safety equipment i.e., respirator cartridges, boots, gloves, tyvek, etc.
- o Additional equipment as necessary for the field tasks.

13.1.1 Century OVA 128 Meter

Primary filter-The primary filter will be cleaned after each day of use. This filter is located behind the sample

inlet connector (Fitting Assembly) on the Side Pack Assembly and is removed for cleaning by using a 7/16 inch thin wall socket to unscrew the Fitting Assembly. The filter cup, "O" ring and loading spring will then come out. The porous stainless filter cup will be cleaned by blowing out or heating the filter.

Secondary filter-A particle filter is located in each pick-up fixture. One of these filters must be in the sample line whenever the instrument is in use. The OVA 128 uses a porous metal filter which can be replaced or cleaned.

Mixer/burner Assembly Filter-A porous metal particle filter is incorporated in the Mixer/Burner Assembly which screws into the Preamp Assembly. This filter is used as the sample mixer and inlet flame arrestor in the chamber. This filter does not become contaminated under normal conditions but can be cleaned or the assembly replaced as necessary.

Access to this filter or output surface does not require removing the instrument from the case. For access, remove the safety cover using a hex key wrench (supplied) then unscrew the exhaust port. If necessary, the Filter Assembly will be cleaned with a small wire brush.

Exhaust Flame Arrestor-A porous metal flame arrestor is located in the exhaust port of the detector chamber (Preamp Assembly). It acts as a particle filter on the chamber output and restricts foreign matter from entering the chamber. This filter will be cleaned by removing the exhaust port. This filter is cleaned with a detergent and is completely baked out at 120°F before reinstalling.

Sampling Fixtures-Sampling fixtures will be cleaned with an air hose and/or detergent water to eliminate foreign particle matter.

The following procedures refer to maintenance for the gas chromatographic mode of operation:

Column-Any column can be contaminated with compounds having long retention times. This is evident by the occurrence of high background readings. If these are observed, the contaminated column will be baked at 100°C (212°F) for 3-4 hours in a drying oven while passing nitrogen through the column.

Charcoal Filter Assembly-After repeated use, the Charcoal Filter Assembly will become saturated. Periodically, the operator will check the effectiveness of the activated charcoal.

This will easily be done by operating the unit with the Sample Injection Valve "in" and passing the probe near a concentrated sample of the compound being analyzed. If the rise is more than 2 ppm, the old charcoal will be replaced with new activated charcoal.

The above mentioned filters will be maintained as spare parts. Additionally, the following items will be maintained:

ITEM DESCRIPTION	FOXBORO PART NUMBER
Quad Rings	510496-1
Tubing, .148 in ID .020 wall	12942
Tubing, teflon .120 in ID .030 in wall	12941
Activated charcoal	
"0" Ring for charcoal scrubber	U0118CE
Chart Paper (linear)	

13.1.2 PUF Sampling Equipment

Maintenance will be the same as for the high volume particulate equipment. The spare parts list will include

but are not limited to (Section 13) two (2) extra glass cartridges for the PUF plug and twenty (20) unexposed PUF plugs. Additional PUF plugs will be obtained from Enseco when it is determined that the number is not sufficient to complete the project. Enseco will provide the initial cleaning of the PUF plugs.

13.1.3 Tenax, XAD-2, and CMS Sampling Equipment

A spare pump will be maintained on site at all times. Any extra pumps may be obtained from the manufacturer within 24-hours. Should a malfunction occur, repairs will be accomplished by the factory. The same is true for the mass flow meters. A spare mass flow meter will not be maintained on site but will be available within 24 hours from the factory. Twenty traps each of Tenax, XAD-2, and CMS will initially be on-site at the start of the project. If it becomes apparent that this will not be sufficient to complete the project additional traps will be obtained from Enseco.

13.1.4 HNU Model P1 101 Photoionization Unit

This instrument contains only one moving part, and consumes no gases or reagents. The only routine maintenance procedure is cleaning the light source window. A spare lamp will be maintained on site.

13.1.5 High Volume Particulate Sampling Equipment

Sampler Motor-Motor brushes will be replaced any time a rotameter reading drops below 50 with a clean filter. All brushes must be replaced at least every six months. The hi-vol sampler will be recalibrated before and after the brushes are changed.

Face Plate Gasket-A worn face plate gasket is characterized by the gradually blending of the inter-face between collected particulates and the clean filter border. Any decrease in the original sharpness of this interface indicates the need for a new face plate gasket.

Rotameter-Small particles may become lodged in the air cavity of the rotameter, resulting in erratic behavior of the float. The rotameter will be cleaned and calibrated at any sign of foreign particles or moisture deposits in the air column. The rotameter will be cleaned prior to routine calibration. If any physical damage, such as a crack, is observed the rotameter will be discarded.

Other Maintenance-All other maintenance will be performed as required. All hi-volume samplers shall be calibrated at least once each Quarter. This should be done, if possible, the first week of each Quarter (first week of January, April, July and October). All maintenance and calibration records shall be recorded in a field log book, along with the date the work was performed and the initials of the person performing the work.

Supplies-The following list of parts will be maintained at all times. Additional parts or supplies shall be ordered any time inventory reaches the following values:

- Hi-vol brushes - 5 sets
- Face plate gaskets - 1
- One complete hi-vol motor
- Two extra rotameters
- 25 feet of 3/16-inch I.D. tubing
- Five 15-amp fuses
- 50 filters

13.2 Laboratory Preventative Maintenance

Erco maintains a complete inventory of replacement parts needed for preventive maintenance and spare parts that routinely need replacement (e.g., gauges, detectors, etc.). If an instrument fails, the problem will be diagnosed as quickly as possible and either replacement parts will be ordered or a service call will be placed with the manufacturer. Service contracts are in effect for the data systems controlling operation of GC/MS systems.

Preventive maintenance scheduled for analytical instrumentation are included in Enseco's laboratory manuals and are given in Figures 13-1 through 13-6.

FIGURE QAPP 13-1

PREVENTIVE MAINTENANCE SCHEDULE FROM
ERCO'S TRACE METALS LABORATORY MANUAL (AA)

MAINTENANCE OF PERKIN ELMER 603 ATOMIC ABSORPTION
SPECTROPHOTOMETERS, PERKIN ELMER 4000 ATOMIC ABSORPTION
SPECTROPHOTOMETER, FISHER MERCURY ANALYZER

I. Nebulizer, Mixing Chamber, and Burner Maintenance

Cleaning of the nebulizer, mixing chamber, and burner system cannot be scheduled; the frequency of cleaning is left to the discretion of the analyst, who should keep the following guidelines in mind.

- A) Following aspiration of organic solutions, cleaning should be done in the manner described in Section 10B,3 of the Perkin Elmer 603 instruction manual.
- B) The burner and mixing chamber should be cleaned when analyzing for very low levels of an element and the previous sample lot has had the same element as a major constituent (Section 10B,2 and/or 10B,5).
- C) Aspiration of high-solid samples (solid \geq 4 percent for 10 cm and 1 percent for 5 cm burner head) requires a minimum of daily cleaning of the burner head. The burner will also require cleaning when discontinuities in the flame occur as a result of dry solids lodged in the burner slot (Section 10B,2).
- D) The burner system must be cleaned following the aspiration of high concentrations of Ag, Cu, or Hg to prevent the build-up of explosive acetylide compounds (Section 10B,4).
- E) Assuming the nebulizer calibration has not been altered, a decrease in sample uptake indicates a need to clean the nebulizer (Section 10C,1).

II. Drain-Trap and Waste-Vessel Maintenance

- A) The waste vessel should be emptied when necessary, but in a manner that will leave enough residual water (5 inches) to submerge the end of the drain tube.
-

FIGURE QAPP 13-1 (cont'd)

PREVENTIVE MAINTENANCE SCHEDULE FROM
ERCO'S TRACE METALS LABORATORY MANUAL (AA)

B) The drainage system should be inspected each morning before flame ignition in order to prevent flashback explosions. The water trap should consist of a full-to-capacity 6-inch diameter loop. The end of the drain tube should be submerged in a minimum of 5 inches of liquid.

III. Sample Compartment-Window Maintenance

The sample compartment windows should be inspected and cleaned when any dirt is visible. The windows should be cleaned weekly even if they appear to be clean. Ultraviolet absorption losses can occur with optical components, even when visibly clean (Section 100,4).

IV. Maintenance of Gas Supplies

A) WARNING - Linde-brand acetylene from Union Carbide cannot be used. The acetylene vehicle can dissolve internal plumbing and result in an explosion.

B) Only instrument-grade gases will be used.

C) Compressed air from an ambient air compressor utilizing water and oil traps is preferable to compressed cylinder gas that can suffer from alterations in O₂/N₂ ratio.

D) The nitrous oxide regulator should be monitored for condensation build-up on humid days. If condensation is noticed, a heated regulator or an IR heat lamp should be employed.

FIGURE QAPP 13-2

PREVENTIVE MAINTENANCE SCHEDULE FROM
ERCO'S TRACE METALS LABORATORY MANUAL (ICP)

MAINTENANCE OF THE JARRELL-ASH ATOMCOMP
INDUCTIVELY COUPLED PLASMA SPECTROPHOTOMETER

Timing of maintenance must be determined by the principal operator from instrument performance. Areas to keep under observation for routine cleaning are listed below. The majority of maintenance for this instrument and its associated computer will be nonroutine and logged in the appropriate maintenance log.

1. Mixing chamber, nebulizer, and torch assembly should be inspected and cleaned when necessary (i.e., after high dissolved solids or organic solutions are aspirated).
 2. Fore-optic assemblies should be inspected for damage and corrosion.
 3. Exhaust system should be checked.
 4. Cooling fans and air filters should be checked and cleaned periodically (both for the computer and RF generator).
 5. Instrument housing, RF generator housing, and teletype should be wiped with a damp cloth periodically.
-

FIGURE QAPP 13-3

PREVENTIVE MAINTENANCE SCHEDULE FROM ERCO'S
TRACE METALS LABORATORY MANUAL (Graphite Furnace)

MAINTENANCE OF HEATED GRAPHITE FURNACE (HGA-2100)

- A) Plumbing should be checked for possible leaks when cooling water is turned on.
 - B) Power cables should be hand-tight before power to HGA control unit is turned on.
 - C) Graphite tubes should be cleaned of any residue (Section 4-1, HGA manual). If the graphite surfaces appear excessively burnt, are cracked, or, if after cleaning unacceptable precision persists, the tube should be replaced.
 - D) Graphite contact rings should be replaced when excessive wear is noted (Section 4.B).
 - E) Atomizer windows should be cleaned daily or more frequently if clouding is noted (Section 4.C).
 - F) Argon flow gas shall be used for all priority pollutant analyses. Proper flow of purge gas should be maintained to prevent excess wear of graphite components.
 - G) Sample compartment windows should be inspected and cleaned when any dirt is visible. The windows should be cleaned weekly even if they appear clean. Ultra-violet absorption losses can occur even when visibly clean (Section 10D, 4; PE 603 manual).
-

FIGURE QAPP 13-4

PREVENTIVE MAINTENANCE SCHEDULE FOR GAS CHROMATOGRAPHS
FROM ERCO'S ORGANIC LABORATORY MANUAL

Table B-1. Mainframe Maintenance Schedule

Area or Assembly	Type of Maintenance	Interval
Exterior surface	Cleaning	As conditions indicate
Air filter	Cleaning Replacement	6 months as required

Table B-2. Terminal Systems Maintenance Schedule

Area or Assembly	Type of Maintenance	Interval
Functional terminal		
Paper	Loading	As required
Printhead	Cleaning	As required
Cartridge tape unit		
Tapes	Storage	
Tapes	Conditioning	Every new tape
CTU	Cleaning	One week

Table B-3. Valve System Maintenance Schedule

Area or Assembly	Refer to
Valves	18900C Valve Manual (Part No. 18900-90130)

FIGURE QAPP 13-4 (cont'd)

PREVENTIVE MAINTENANCE SCHEDULE FOR GAS CHROMATOGRAPHS
FROM ERCO'S ORGANIC LABORATORY MANUAL

Table B-4. Flow System Maintenance Schedule

Area or Assembly	Type of Maintenance	Interval
Moisture Trap (between external supply & GC)	Conditioning	2 months, or when gas source is changed
Moisture Trap (between external supply & GC)	Repacking	Every 10 conditionings
Chemical Filter (between flow controller & injection port)	Conditioning	2 months, or when gas source is changed
Carrier Gases	Leak check	As required
Support Gases	Leak check	As required
Air Solenoid	Adjustment	Initial setup or when flow conditions change
H ₂ /air adjustment	Cleaning	As required
Column	Conditioning	When column is changed, or when chromatographic conditions or samples require
Column	Repacking	As required
Ni Catalyst	Conditioning	6 months, or as required

FIGURE QAPP 13-4 (cont'd)

PREVENTIVE MAINTENANCE SCHEDULE FOR GAS CHROMATOGRAPHS
FROM ERCO'S ORGANIC LABORATORY MANUAL

Table B-5. Injection System Maintenance Schedule

Area or Assembly	Type of Maintenance	Interval
Injection port		
Inj. port	Cleaning	As required
Septum	Replacement	Every 10 manual injections
Inj. port	Leak check	As required
Chem. filter	Conditioning	
Capillary inlet		
Cap. inlet	Leak test	As required
Septum	Replacement	1 week (more frequently when using large needle)
Insert	Cleaning	Whenever insert is changed
Insert seal	Replacement	Whenever leak occurs or damage is apparent
Inlet vent tube	Cleaning	3 months
Column seal	Replacement	Whenever leak occurs or damage is apparent
Autosampler		
Transport	Alignment Resetting stops	As required
Needle	Positioning	On installation, then as required

FIGURE QAPP 13-4 (cont'd)

PREVENTIVE MAINTENANCE SCHEDULE FOR GAS CHROMATOGRAPHS
FROM ERCO'S ORGANIC LABORATORY MANUAL

Table B-6. Detector System Maintenance Schedule

Area or Assembly	Type of Maintenance	Interval
FID/NPD	Leak check	As required
FID	Cleaning	As required
FID/NPD jet	Cleaning	2 months for capillary. As required for packed columns
FID collector	Cleaning	As required
FID/NPD Air/H ₂ controls	Cleaning	As required
FID/NPD air solenoid	Adjustment	Initial setup or when flow conditions change
ECD	Freq. check	1 day
ECD	Carrier gas eval.	When carrier gas is changed
	Leak check	When column is changed
ECD	Thermal clean	1 month
ECD	NRC wipe test	6 months

FIGURE QAPP 13-5

S.O.P.
Preventive Maintenance

1. Traps -- Chloromethane response factors are monitored through the use of a Quality Control chart. Trap is replaced when chloromethane response factor falls below 0.3.
 2. Chromatographic columns -- Resolution of peaks and column bleed are visually monitored on daily chromatograms. Retention time is monitored on Quality Control charts. When any of these factors causes or indicates a fall in chromatographic performance, the column is replaced.
 3. Source cleaning -- BFB tunes are monitored daily to ensure that they meet EPA quality control requirements. When tune criteria cannot be met, the source is cleaned to restore instrument performance.
 4. Electron multiplier -- As electron multiplier dynode surfaces wear, instrument sensitivity is reduced. This is compensated for by increasing multiplier gain. When maximum gain no longer provides required sensitivity, the electron multiplier is replaced.
 5. Injection port septa -- Septa are changed every 10 injections to ensure against sample loss, carrier gas loss, and pressure drops.
 6. Preventive maintenance -- Routine maintenance is performed on vacuum pump oils and GC/MS absorbent trap packings.
-

FIGURE QAPP 13-6
MAINTENANCE FOR GC/MS SYSTEMS

PREVENTIVE MAINTENANCE CHECKS							
ITEM	SERVICE INTERVAL ¹						SERVICE LEVEL
	Dy	Wk	Mo	Qu	Bi	An	
HP 5840A GC							
• Septa		X					Inspect and replace as required.
• Injection port liner		X					Clean or replace.
• Carrier gas filter				X			Replace.
• Capillary column		X			X		Clip or replace as required.
HP 5985 MS							
• Ion gas tube	X						Operate Degas mode for 30 sec.
• Ion source filament				X			Replace as needed.
• Ion source					X		Inspect and clean.
• Electron multiplier					X		Replace as required.
• Teflon seal in direct introduction inlet				X			Replace.
• Vacuum pumps					X		Inspect belt and change oil.
HP 7900 Disc Drive					X		Service contract P.M.
Tektronix hardcopy unit			X		X		Clean and inspect. Service contract P.M.
Finnigan 9610 GC							
• Septa		X					Inspect and replace as required.
• Injection port liner		X					Clean or replace.
• Carrier gas filter				X			Replace.
• Capillary column		X			X		Clip or replace as required.
Printronic Printer							
• Interior			X				Clean and inspect.
• Printer ribbon			X				Change as needed.
• Preventive maintenance					X		
Finnigan 4530 MS							
• Quadrupole mass analyzer					X		Clean rod assembly.
• Ion source				X			Clean and inspect.
• Cal gas assembly					X		Inspect.
• Ion source filament				X			Replace as needed.
• Electron multiplier					X		Replace as needed.
• Vacuum pumps				X			Inspect and change oil.
Control Data CMD Disk Drive				X			Service contract preventive maintenance.
• Air filters				X			
• Power supply outputs					X		
• Actuator assembly					X		

¹Da = daily; Wk = weekly; Mo = monthly; Qu = quarterly; Bi = biannually; An = annually.

¹Da = daily; Wk = weekly; Mo = monthly; Qu = quarterly; Bi = biannually; An = annually.

14.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS PRECISION, ACCURACY AND COMPLETENESS

14.1 Overall Project Assessment

Overall data quality will be assessed by a thorough understanding of the Project objectives and data quality objectives which are stated during the design phase of the investigation. By maintaining thorough documentation of all decisions made during each phase of sampling, performing field and laboratory audits, thoroughly reviewing (validating) the analytical data as it is generated by the laboratory, and providing appropriate feedback as problems arise in the field or at the laboratory, ERM will closely monitor data accuracy, precision and completeness.

14.2 Field Data Quality Assessment

To assure that all field data are collected accurately and correctly, specific written instructions will be issued to all personnel involved in field data acquisition by the Project Manager. The Project QA/QC Manager will perform field audit(s) during the investigation to document that the appropriate procedures are being followed with respect to sample (and blank) collection. These audits will include a thorough review of the field books used by the Project personnel to insure that all tasks were performed as specified in the instructions. The field audits will necessarily enable the data quality to be assessed with regard to the field operations.

The evaluation (data review) of field blanks, and other field QC samples will provide definitive indications of the

data quality. If a problem arises and can be isolated, corrective actions will be instituted for future field efforts.

14.3 Enseco's Procedures

For this project, the methods to determine precision and accuracy, and their acceptability is well defined in the EPA CLP contract. All other parameters requested will be subject to a method validation study and precision, accuracy, and completeness will be based on the results of this study. In general, for all non-routine parameters, accuracy is calculated through percentage recovery, and precision expressed in percentage difference or percentage relative standard deviation. Acceptance limits are ± 3 SD from the mean.

14.3.1 Precision

Precision is frequently determined by the comparison of duplicates, where duplicates result from an original sample that has been split for identical analyses. Standard deviation(s) of a sample is commonly used in estimating precision.

$$\text{Sample standard deviation}(s) = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2}$$

where a quantity x (e.g., a concentration) is measured n times with a mean \bar{x} .

The relative standard deviation, RSD (or sample coefficient of variation, CV), which expresses standard deviation as a percentage of the mean, is generally useful in the comparison of three or more duplicates.

$$RSD = 100 (s/\bar{x})$$

or

$$CV = 100 (s/\bar{x})$$

where RSD = relative standard deviation, or

CV = coefficient of variation

s = standard deviation

—

x = mean

In the case of duplicates -- samples that result when an original sample has been split into two for identical analyses -- the percent difference (%D) between the two samples may be used to estimate precision.

$$\%D = \frac{D_1 - D_2}{(D_1 + D_2)/2} \times 100$$

where: %D = percent difference

D₁ = first sample value

D₂ = second sample value (duplicate)

14.3.2 Accuracy

The determination of accuracy of a measurement requires a knowledge of the true or accepted value for the analyte being measured. Accuracy may be calculated in terms of bias as follows:

$$\text{Bias} = \bar{X} - T$$

$$\% \text{Bias} = 100(\bar{X} - T)/T$$

where: \bar{X} = average observed value of measurement

T = "true" value

Accuracy may also be calculated in terms of the recovery of spiked samples:

$$\% \text{Recovery} = 100 \frac{X}{T}$$

14.3.3 Analytical Completeness

Determining whether a data base is complete or incomplete may be quite difficult. To be considered complete, the data set must contain all QC check analyses verifying precision and accuracy for the analytical protocol. Less obvious is whether the data are sufficient to achieve the goals of the project. All data are reviewed in terms of goals in order to determine if the data base is sufficient.

Where possible, the percent completeness for each set of samples is calculated as follows:

$$\% \text{ completeness} = \frac{\text{valid data obtained}}{\text{total data needed}} \times 100$$

14.3.4 Objectives

Objectives in terms of completeness, precision, and accuracy can be found in Section 5.

14.3.5 Reporting

Precision and accuracy data will be calculated at the time of the analysis from the laboratory perspective. If the control limits have been exceeded, the sample will be reanalyzed according to CLP reanalysis protocols. All

laboratory precision and accuracy results (standards: %RSD, %D; samples: surrogate recoveries, matrix spike recoveries, RPD's on duplicates) will be presented in tabular form in the report.

14.4 ERM's Laboratory Data Assessment

14.4.1 ERM Data Validation

All analytical data generated during the investigation will undergo a rigorous ERM data review. This review will be performed in accordance with the "Functional Guidelines for the Evaluation of Organic and Inorganic Analysis." (U.S. EPA 1988) and a draft EPA document for the "Evaluation of Dioxin and Furan Analysis."

A preliminary review will be performed to verify all necessary paperwork (chain-of-custodies, analytical reports, laboratory personnel signatures) and deliverables (as stated in EPA CLP SOW 8/87) for both organic and inorganic analyses are present.

A detailed quality assurance review will be performed by the Project QA/QC Manager to verify the qualitative and quantitative reliability of the data as it is presented. This review will include a detailed review and interpretation of all data generated by Enseco and CAL Analytical. The primary tools which will be used by experienced data review chemists are to be guidance documents, established (contractual) criteria, and professional judgment. Table 14-1 presents the items examined during the quality assurance review.

Based upon the review of the analytical data, an organic and inorganic quality assurance report will be prepared which

QAPP TABLE 14-1

ITEMS REVIEWED DURING THE ERM DATA VALIDATION

<u>Areas Examined</u>	<u>Applicability</u> (organic, inorganic, both)
ERM and Laboratory Chain of Custodies (Field Notes, Etc)	Both
Laboratory Narrative and QC Summaries	
Holding Times	Both
Extraction/Digestion Logs	Both
Blanks-field and laboratory (accuracy)	Both
Instrument Tune	Organic
Standards	Both
Linearity	Both
Sensitivity/Stability	Both
Selectivity/Specificity	Both
EPA Criteria (SPCC & LCS)	Both
Variability of Technique (internal standards)	Organic
Analyte Breakdown	Organic
Analytical Sequence	Organic
ICP Interference	Inorganic
Control Standards	Inorganic
Serial Dilutions	Inorganic
Samples	
Detection Limits	Both
Instrument Printouts	Both
ICP data	Inorganic
AA data	Inorganic
GC data	Organic
GG/MS data	Organic
Autoanalyzer data	Inorganic
Qualitative Identification	Both
Mass spectra	
Pesticide/PCB results	
Tentatively identified compounds	
Quantitative Reliability	Both
Calculations/Equations	Both
Matrix spikes (accuracy)	Both
Bias	
Matrix spike duplicates	Organic
Bias	
Accuracy & Precision	
Surrogate Spikes	Organic
Bias	
Duplicates (field and laboratory)	Both
Precision	
Representativeness	
Post-Digestion Spikes (GFAA)	Inorganic
Matrix Effects	

will state in a technical yet "user friendly" fashion the qualitative and quantitative reliability of the analytical data. The report will consist of a general introduction section, followed by qualifying statements that should be taken into consideration such that the analytical results can be best utilized. Based upon the quality assurance review, qualifier codes will be placed next to specific sample results on the sample data tables. These defined qualifier codes will serve as an indication of the qualitative and quantitative reliability.

During the course of the data review, an organic and inorganic support documentation package will be prepared which will provide backup information that will accompany all qualifying statements presented in the quality assurance review.

Once the review has been completed, the Project QA/QC Manager will submit these data to the Project Manager. These approved data tables and quality assurance reviews will be signed and dated by the Project QA/QC Manager.

After the analytical data has been reviewed by ERM's Project QA/QC Manager, the data package will be forwarded to U.S. EPA Region 5 as part of U.S. EPA's review process.

14.5 Management Data Quality Assessment

The analytical data generated from the investigation are validated, qualified and submitted to the Project Manager. The quality of the data will be assessed from an overall management perspective by an evaluation of the analytical results with respect to the project and data quality objectives. Information that can be obtained includes determination of the adequacy of current data points and the

identification of missing data points. By examination of the collective data at the "back-end" of the process, data quality will be assessed with respect to all of the PSARCC objectives.

15.0 CORRECTIVE ACTION

15.1 ERM's Corrective Action

One of the critical roles in a QA/QC Program is the implementation of corrective actions in the event that problems arise. During any large investigation, many large or small problems may arise. The Project QA/QC Manager will notify the Project Manager who is ultimately responsible for taking appropriate corrective action. The U.S. EPA and OEPA Project Coordinators will be informed of the problem and the proposed course of action to be taken if it is not determined to be acceptable to them.

To assess the quality of the samples collected in the field and to determine if there is a need for corrective action, field procedures will be evaluated through various audits. Some of the areas examined in the audit processes are summarized below.

- o Sampling procedures are in accordance with the SSSP and QAPP
- o Indications of faulty sampling equipment or inappropriate bottleware and preservatives
- o Fully completed field data sheets for all activities
- o Strict chain-of-custody on all supplies collected

Any such problems identified during the investigation will be reported on a Corrective Action Form as presented in Figure 15-1. The aforementioned examples are tests for soundness that will be checked during data evaluation and

Qa Officer - _____

interpretation. Any errors or problems will be corrected by an appropriate action which may include:

- o Replacing or repairing a faulty measurement system
- o Discarding erroneous data
- o Collecting new data
- o Accepting the data and acknowledging a level of uncertainty

15.2 Enseco's Corrective Action

Corrective actions for laboratory problems are specified in Enseco laboratory manuals and standard operating procedures. Specific QC procedures are designed to help analysts determine the need for corrective action. Often, personal experience is most valuable in alerting the analyst to suspicious data or malfunctioning equipment. Corrective action taken at this point helps to avoid collection of poor quality data.

Problems not immediately detected during the course of analysis may require more formalized, long-term corrective action. The essential steps in the corrective action system are:

1. Identify and define the problem.
2. Assign responsibility for investigating the problem.
3. Investigate and determine the cause of the problem.

4. Determine a corrective action to eliminate the problem.
5. Assign and accept responsibility for implementing the corrective action.
6. Establish effectiveness of the corrective action and implement it.
7. Verify that the corrective action has eliminated the problem.

This scheme is generally accomplished through the use of the Corrective Action Request Form (Figure 15-2) which is available to all Enseco personnel. Using this form, any laboratory analyst or project member may notify the QA Director of a problem. The QA Director initiates the corrective action scheme by relating the problem to the appropriate laboratory managers and/or project managers who investigate or assign responsibility for investigating the problem and its cause. Once determined, an appropriate corrective action is approved by the QA Director. Its implementation is later verified through a laboratory audit.

Information contained on a Corrective Action form is kept confidential within Enseco and is generally limited to the individuals involved. Severe problems and difficulties may warrant special reports to the Corporate Vice President of QA who will ensure that the appropriate corrective actions are taken.

Close scrutiny is paid to the quality and validity of the analytical data for any given analysis. Variations of more than two standard deviations (unless stricter controls are stipulated in the method used) will warrant corrective

action procedures. The nature of such will be determined by the method employed. In most instances, a reanalysis (and possibly a recalibration) may be necessary to correct the problem.

16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT16.1 ERM's Quality Assurance Reports

A quality assurance report will be prepared at the end of each pertinent task effort by the Project Manager in conjunction with the Project QA/QC Manager. This report will be forwarded to the appropriate project coordinators. The report will provide information on the performance of measurement systems and data quality and will include the following information:

- o The status and coverage of various laboratory and field quality assurance project activities
- o Data quality assurance reviews including assessment of: accuracy, precision, completeness, representativeness, and comparability
- o Significant quality assurance problems discovered, corrective actions taken, progress and improvements, plans, and recommendations for further implementation or updating of the investigative QAPP
- o Any significant field observations noted in the field notebook during the sampling procedure
- o A summarization of any performance and/or system audits that took place

16.2 Enseco's Quality Assurance Reports

Enseco's QA Director is required to submit monthly QA reports to the President of ERCO and to the Corporate Vice President of QA. The reports will include detailed information on the following items:

1. Systems audit reports
2. Scores of and comments on performance evaluation samples
3. Number of quality control samples performed and results of such samples
4. Results of on-site visits and audits by regulatory agents and other clients
5. Status of major contracts, projects, and certifications
6. Problems and corrective actions
7. General comments

The Corporate Vice President of Enseco is required to submit monthly reports to each member of the Executive Committee, the Chairman of the Board of Directors, and each Divisional President. These reports should include a summary of the reports submitted by the laboratory QA Directors, reports of the Corporate Vice President's systems audits and site inspections at each laboratory, results of performance evaluation samples that are sent to the laboratories, recommendations, and comments.

In case of severe problems and difficulties, special reports will be prepared and submitted to the project management in a timely manner.

Volume 2: Attachments

Ruetgers-Nease Salem, Ohio Site

Revision 4: February 28, 1990
Revision 3: December 13, 1989
Revision 2: August 3, 1989
Revision 1: October 22, 1988

Submitted to

United States Environmental Protection Agency, Region 5
Hazardous Waste Enforcement Branch
230 S. Dearborn St.
Chicago, Illinois 60604

Ohio Environmental Protection Agency
Corrective Actions Section
Division of Solid and Hazardous Waste Management
1800 Watermark Dr.
Columbus, Ohio 43266

Northeast District Office
Division of Solid and Hazardous Waste Management
2110 Aurora Rd.
Twinsburg, Ohio 44087

Submitted by

Ruetgers-Nease
Chemical Company, Inc.
201 Struble Rd.
State College, Pennsylvania 16801

ERM-Midwest, inc.

ATTACHMENT #1

**Enseco's SOP for the Analysis of TCL, VOA,
BNA and Pesticide/PCB's in Fish Tissue**

**[THIS DOCUMENT IS CONFIDENTIAL AND IS ON FILE
WITH BOTH THE OHIO EPA AND THE U.S. EPA]**